

AD20-21

VRGC: 13VAC5-31-20.

Proponents: Amusement Device Technical Advisory Committee (ADTAC)

2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-31-20. Definitions.

A. The following words and terms when used in this chapter shall have the following meanings unless the context clearly indicates otherwise:

"Serious Injuries/Illnesses" means a personal injury/illness that results in death, dismemberment, significant disfigurement, permanent loss of the use of a body organ, member, function, or system, a compound fracture, or other significant injury/illness that requires immediate admission and overnight hospitalization and observation by a licensed physician.

B. Words and terms used in this chapter which are defined in the USBC shall have the meaning ascribed to them in that regulation unless the context clearly indicates otherwise.

C. Words and terms used in this chapter which are defined in the standards incorporated by reference in this chapter shall have the meaning ascribed to them in those standards unless the context clearly indicates otherwise.

Reason Statement: The VADR (13VAC5-31-85) states "If an accident involving the serious injury or death of a patron occurs, the operation of an amusement device shall cease and the local building department and DHCD shall be notified as soon as practicable, but in no case later than during the next working day. This proposal is a recommendation from the Amusement Device Technical Advisory Committee (ADTAC) and provides a definition for "serious injury/illness", as referenced in 13VAC5-31-85. The definition is borrowed from ASTM F747 "Standard Terminology Relating to Amusement Rides and Devices".

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
No resiliency impact.



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is for clarification only and is not anticipated to have a cost impact.

AD30-21

VRGC: 13VAC5-31-30.

Proponents: Amusement Device Technical Advisory Committee (ADTAC)

2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-31-30. Devices covered and exempt.

A. The following devices, identified by name or description, when open to the public shall be considered amusement devices subject to this chapter. The list is intended only to clarify questionable devices, while the definition of an "amusement device" in 13VAC5-31-20 is generally used to determine the applicability of this chapter.

1. Inflatable amusement devices;
2. Zip lines; and
3. Trampoline courts

I. B. The following equipment or devices shall not be considered amusement devices subject to this chapter:

1. Nonmechanized playground or recreational equipment such as swing sets, sliding boards, climbing bars, jungle gyms, skateboard ramps and similar equipment ~~where no admission fee is charged for its use or for admittance to areas where the equipment is located;~~
2. Coin-operated rides designed to accommodate three or less passengers;
3. Water slides or similar equipment used in community association, community club or community organization swimming pools;
4. Mechanical bulls or similar devices;
5. Devices known as mall trains, shopping mall trains, or electric trackless trains for malls; and
6. Devices known as water walking balls, euro bubbles, or similar devices.

Reason Statement: This proposal is a recommendation from the Amusement Device Technical Advisory Committee (ADTAC) to clarify that non-mechanized playground equipment that you typically see in a backyard, at a school, in a public park, etc, is not considered an amusement device. If it is mechanized equipment, or it is not typical backyard playground equipment, the existing "amusement device" definition should be utilized to determine if it is a regulated amusement device. This change will clarify that a typical backyard swingset is not an amusement device, just because it is located within an area that you must pay admission to enter; however, a giant fair slide is not playground equipment and would meet the "amusement device" definition as it is open to the public and moves the rider in an unusual manner.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
No resiliency impact.



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is for clarification only and is not anticipated to have a cost impact.

AD40-21

VRGC: 13VAC5-31-40.

Proponents: Amusement Device Technical Advisory Committee (ADTAC)

2018 Virginia Amusement Device Regulations

2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-31-40. Incorporated standards.

A. The following standards are hereby incorporated by reference for use as part of this chapter:

1. American National Standards Institute (ANSI) Standard No. B77.1-2017 for the regulation of passenger tramways; and
2. American Society for Testing and Materials (ASTM) Standard Nos. ~~F747-15~~ F747-21a, ~~F770-18~~ F770-21a, ~~F1159-16~~ F1159-16e1, ~~F1193-18~~ F1193-18a, F1957-99 (2017), F2007-18, ~~F2137-18~~ F2137-19, ~~F2291-19~~ F2291-21, ~~F2374-19~~ F2374-21a, F2375-09 (2017), ~~F2376-17a~~ F2376-21a, ~~F2460-18~~ F2460-19, ~~F2461-18~~ F2461-20a, ~~F2959-18~~ F2959-21, F2960-16, ~~F2970-17~~ F2970-20, ~~F2974-19~~ F2974-20, and F3054-18 for the regulation of amusement devices.


The standards referenced above may be procured from:

ANSI
25 W 43rd Street
New York, NY 10036

ASTM
100 Barr Harbor Dr.
West Conshohocken, PA 19428-2959

1. B. The provisions of this chapter govern where they are in conflict with any provisions of the standards incorporated by reference in this chapter.
2. C. The following requirements supplement the provisions of the ASTM standards incorporated by reference in this chapter:
 1. The operator of an amusement device shall be at least 16 years of age, except when the person is under the supervision of a parent or guardian and engaged in activities determined not to be hazardous by the Commissioner of the Virginia Department of Labor and Industry;
 2. The amusement device shall be attended by an operator at all times during operation except that (i) one operator is permitted to operate two or more amusement devices provided they are within the sight of the operator and operated by a common control panel or station and (ii) one operator is permitted to operate two small mechanical rides with separate controls provided the distance between controls is no more than 35 feet and the controls are equipped with a positive pressure switch; and
 3. The operator of an amusement device shall not be (i) under the influence of any drugs which may affect the operator's judgment or ability to assure the safety of the public or (ii) under the influence of alcohol.
3. D. Where an amusement device was manufactured under previous editions of the standards incorporated by reference in this chapter, the previous editions shall apply to the extent that they are different from the current standards.

Reason Statement: This code change proposal updates the ASTM standards for the regulation of amusement devices to their most current editions.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency. 

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This code change proposal will not increase or decrease the cost of construction.

B102.3(2)-21

VCC: 102.3

Proponents: Amusement Device Technical Advisory Committee (ADTAC)

2018 Virginia Construction Code

Revise as follows:

102.3 Exemptions. The following are exempt from this code:

1. *Equipment* and wiring used for providing utility, communications, information, cable television, broadcast or radio service in accordance with all of the following conditions:
 - 1.1. The *equipment* and wiring are located on either rights-of-way or property for which the service provider has rights of occupancy and entry.
 - 1.2. Buildings housing exempt *equipment* and wiring shall be subject to the USBC.
 - 1.3. The *equipment* and wiring exempted by this section shall not create an unsafe condition prohibited by the USBC.
2. Support *structures* owned or controlled by a provider of publicly regulated utility service or its affiliates for the transmission and distribution of electric service in accordance with all of the following conditions:
 - 2.1. The support *structures* are located on either rights-of-way or property for which the service provider has rights of occupancy and entry.
 - 2.2. The support *structures* exempted by this section shall not create an unsafe condition prohibited by the USBC.
3. Direct burial poles used to support *equipment* or wiring providing communications, information or cable television services. The poles exempted by this section shall not create an unsafe condition prohibited by the USBC.
4. Electrical *equipment*, transmission *equipment*, and related wiring used for wireless transmission of radio, broadcast, telecommunications, or information service in accordance with all of the following conditions:
 - 4.1. Buildings housing exempt *equipment* and wiring and *structures* supporting exempt equipment and wiring shall be subject to the USBC.
 - 4.2. The equipment and wiring exempted by this section shall not create an unsafe condition prohibited by the USBC.
5. Manufacturing, processing, and product handling machines and equipment that do not produce or process hazardous materials regulated by this code, including those portions of conveyor systems used exclusively for the transport of associated materials or products, and all of the following service equipment:
 - 5.1. Electrical equipment connected after the last disconnecting means.
 - 5.2. Plumbing piping and equipment connected after the last shutoff valve or backflow device and before the equipment drain trap.
 - 5.3. Gas piping and equipment connected after the outlet shutoff valve.Manufacturing and processing machines that produce or process hazardous materials regulated by this code are only required to comply with the code provisions regulating the hazardous materials.
6. Parking lots and sidewalks that are not part of an accessible route.
7. ~~Nonmechanized playground~~ Playground or recreational *equipment* such as swing sets, sliding boards, climbing bars, jungle gyms, skateboard ramps, and similar equipment ~~where no admission fee is charged for its use or for admittance to areas where the equipment is located.~~
8. *Industrialized buildings* subject to the Virginia Industrialized Building Safety Regulations (13VAC5-91) and *manufactured homes* subject to the Virginia Manufactured Home Safety Regulations (13VAC5-95); except as provided for in Section 427 and in the case of demolition of such *industrialized buildings* or *manufactured homes*.
9. Farm *buildings* and *structures*, except for a building or a portion of a building located on a farm that is operated as a restaurant as defined in § 35.1-1 of the Code of Virginia and licensed as such by the Virginia Board of Health pursuant to Chapter 2 (§ 35.1-11 et seq.) of Title 35.1 of the Code of Virginia. However, farm *buildings* and *structures* lying within a flood plain or in a mudslide-prone area shall be subject to flood-proofing regulations or mudslide regulations, as applicable.
10. Federally owned buildings and *structures* unless federal law specifically requires a permit from the *locality*. Underground storage tank installations, modifications and removals shall comply with this code in accordance with federal law.

11. Off-site manufactured intermodal freight containers, moving containers, and storage containers placed on site temporarily or permanently for use as a storage container.
12. Automotive lifts.

Reason Statement: This proposal is a recommendation from the Amusement Device Technical Advisory Committee (ADTAC) to clarify that playground equipment that you typically see in a backyard, at a school, in a public park, etc, are not USBC regulated structures. If it is mechanized equipment, or it is not typical backyard playground equipment, the Virginia Amusement Device Regulations (VADR) may be applicable if the equipment meets the VADR definition of "amusement device". This proposal is a companion to another VADR proposal that has been submitted by the ADTAC to clarify that non-mechanized playground equipment is not an amusement device, regardless of whether it is in an area where admission is required to enter or not.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
No resiliency impact.



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is for clarification only and is not anticipated to have a cost impact.

B313.3-21

VCC: 313.3

Proponents: DHCD Staff (sbco@dhcd.virginia.gov)

2018 Virginia Construction Code

Revise as follows:


313.3 Family day homes. Family day homes registered or licensed by the ~~Virginia Department of Social Services~~ Virginia Department of Education shall be classified as Group R-2, R-3 or R-5.

Reason Statement: Effective July 1, 2021, pursuant to SB578 and HB1012, the oversight for Family Day Homes has been transferred from the Department of Social Services to the Department of Education. The proposal intends to update the code provisions with the appropriate licensing authority for these facilities.

SB578: <https://lis.virginia.gov/cgi-bin/legp604.exe?ses=201&typ=bil&val=sb578&ses=201&typ=bil&val=sb578>

HB1012: <https://lis.virginia.gov/cgi-bin/legp604.exe?ses=201&typ=bil&val=Hb1012&ses=201&typ=bil&val=Hb1012>

For more information, please see the attached document "A Joint Communication of Virginia Departments of Social Services and Education". This is a companion proposal to FP107.12-21.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 
This is an editorial change with no effect on resiliency.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change with no impact on cost.

Attached Files

- **A Joint Communication of Virginia Departments of Social Services and Education.pdf**
<https://va.cdpassess.com/proposal/1057/1353/files/download/573/>

B407.4-21

IBC@: 407.4


Proponents: Daniel Willham (daniel.willham@fairfaxcounty.gov)

2021 International Building Code

Revise as follows:

407.4 Means of egress. Group I-2 occupancies shall be provided with *means of egress* complying with Chapter 10 and Sections 407.4.1 through 407.4.4. ~~The fire~~ Fire safety and evacuation plans ~~provided in accordance with Section 1002.2~~ shall be provided in accordance with the *International Fire Code* and shall identify the building components necessary to support a *defend-in-place* emergency response in accordance with Sections 403 and 404 of the International Fire Code.

Reason Statement: Section 1002.2 of the IBC for evacuation plans is deleted in the VCC, so the requirement for these specifically in I-2 occupancies is broken. This change clarifies the reference to a code section that actually exists.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 
This change is a clarification and is unrelated to resiliency.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a clarification that corrects broken code language and is not a technical change.

B1006.3.4-21

IBC®: TABLE 1006.3.4(1)

Proponents: Lyle Solla-Yates (lyle.sollayates@gmail.com)

2021 International Building Code

Revise as follows:

TABLE 1006.3.4(1) STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM EXIT ACCESS TRAVEL DISTANCE
Basement, first, second, or third, <u>fourth, fifth, or sixth</u> story above grade plane	R-2 ^{a, b}	4 dwelling units	125 feet
Fourth <u>Seventh</u> story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

- a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.
- b. This table is used for R-2 occupancies consisting of dwelling units. For R-2 occupancies consisting of sleeping units, use Table 1006.3.4(2).

Reason Statement: Experience in Seattle and New York City has shown that this kind of development with a limited floorplan can be allowed safely, as well as in other countries. This allows more compact missing middle residential development that was historically common in Virginia but has not been permitted for many years. Reviewers note that there is still a need for reliable aerial access, sprinklers, and alarms.

For more on this see the attached articles "The Single-Staircase Radicals Have a Good Point" by writer Henry Grabar in Slate posted here <https://slate.com/business/2021/12/staircases-floor-plan-twitter-housing-apartments.html> and "The Case for More Single Stair Buildings in the US" by architect Michael Eliason in Treehugger posted here <https://www.treehugger.com/single-stair-buildings-united-states-5197036>

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will decrease the cost of construction

Reducing the number of staircases required for smaller missing middle residential structures will reduce cost per square foot and make more sites and configurations feasible.

Attached Files

- **The Single-Staircase Radicals Have a Good Point Grabar.pdf**
<https://va.cdpass.com/proposal/944/1185/files/download/525/>
- **singlestaireliason.pdf**
<https://va.cdpass.com/proposal/944/1185/files/download/521/>

B1010.2.8-21

VCC: Section 108.1, 110.1.1, SECTION 202, 1010.1.4.4, 1103.2.15; VFC: 1031.11

Proponents: DHCD Staff on behalf of the following stakeholders represented at the Active Shooter and Hostile Threat Events in Public Buildings Study Group: Virginia Building & Code Officials Association, Virginia Fire Prevention Association, Nightlock

2018 Virginia Construction Code

Revise as follows:

Section 108.1 When applications are required. Application for a permit shall be made to the *building official* and a permit shall be obtained prior to the commencement of any of the following activities, except that applications for emergency *construction*, alterations or *equipment* replacement shall be submitted by the end of the first *working day* that follows the day such work commences. In addition, the *building official* may authorize work to commence pending the receipt of an application or the issuance of a permit.

1. *Construction* or demolition of a *building* or *structure*. Installations or alterations involving (i) the removal or addition of any wall, partition or portion thereof, (ii) any structural component, (iii) the repair or replacement of any required component of a fire or smoke rated assembly, (iv) the alteration of any required means of egress system, including the addition or removal of *emergency supplemental hardware*, (v) water supply and distribution system, sanitary drainage system or vent system, (vi) electric wiring, (vii) fire protection system, mechanical systems, or fuel supply systems, or (viii) any *equipment* regulated by the USBC.
2. For *change of occupancy*, application for a permit shall be made when a new certificate of occupancy is required by the VEBC.
3. Movement of a *lot line* that increases the hazard to or decreases the level of safety of an existing *building* or *structure* in comparison to the *building code* under which such *building* or *structure* was constructed.
4. Removal or disturbing of any asbestos containing materials during the *construction* or demolition of a *building* or *structure*, including additions.

110.1.1 Consultation and notification. Prior to approval or removal of *emergency supplemental hardware*, the building code official shall consult with the local fire code official, or state fire code official if no local fire code official exists, and head of the local law-enforcement agency. The local fire code official; the state fire code official; and the local fire, EMS, and law-enforcement first responders shall be notified by the building code official of such approval or removal. ~~after approval or removal of such *emergency supplemental hardware* by the building code official.~~

SECTION 202 DEFINITIONS. "Public Building" - a structure or building that is owned, leased, or otherwise occupied by a municipality or the state and used for any municipal or public purposes by the municipality or the state.

~~1010.1.4.4~~ **1010.2.8 Locking arrangements in educational occupancies** **Emergency Supplemental Hardware.** In Group E occupancies, except Group E day care facilities, ~~and~~ Group B educational occupancies and public buildings, *exit access doors* from classrooms, offices, and other occupied rooms, except for exit doors and doors across corridors, shall be permitted to be provided with *emergency supplemental hardware* where all of the following conditions are met:

1. The door shall be capable of being opened from outside the room with a key, proprietary device provided by the manufacturer, or other *approved* means.
2. The door shall be openable from within the room in accordance with Section 1010.1.9, except *emergency supplemental hardware* is not required to comply with Chapter 11.

Note: School officials and building owners should consult with their legal counsel regarding provisions of the Americans with Disabilities Act of 1990 (42 USC § 12101 et seq.) and any other applicable requirements.

3. Installation of *emergency supplemental hardware* on fire door assemblies must comply with Section 716.2. Modifications shall not be made to listed *panic hardware*, fire door *hardware*, or door closures.
4. The *emergency supplemental hardware* shall not be capable of being used on other doors not intended to be used and shall have at least one component that requires modification to, or is permanently affixed to, the surrounding wall, floor, door, or frame assembly *construction* for it to properly function.
5. Employees shall engage in lockdown training procedures on how to deploy and remove the *emergency supplemental hardware*, and its use shall be incorporated in the *approved* lockdown plan complying with the SFPC.
6. The *emergency supplemental hardware* and its components shall be maintained in accordance with the SFPC.
7. *Approved emergency supplemental hardware* shall be of consistent type throughout a building.

Exception: The *building official* may approve alternate types of *emergency supplemental hardware* in accordance with Section 110.1 when a consistent device cannot be installed.


1103.2.15 Emergency supplemental hardware. In Group E occupancies, except Group E day care facilities, ~~and~~ Group B educational occupancies, and public buildings, when *emergency supplemental hardware* is deployed during an active shooter or hostile threat event and provided in accordance with Section ~~1010.1.4.4.~~ 1010.2.8, is not required to comply with this chapter.

2018 Virginia Statewide Fire Prevention Code

Revise as follows:

1031.11 Emergency supplemental hardware. *Emergency supplemental hardware* shall be installed in accordance with the *applicable building code* and shall be *maintained* in accordance with this code, the conditions of its approval and the manufacturer's instructions. The *fire code official* shall be authorized to revoke the use and storage of *emergency supplemental hardware* within a *building* for due cause based on failure to comply with requirements in this code or the *applicable building code*. Revocations shall be rescinded upon achieving compliance with this code and the *applicable building code*.

Reason Statement: The proposal intends to comply with the SB 333 and HB 670 by expanding on the existing provisions for ESH. The gist of the proposal is the addition of "public buildings" to the list of uses/occupancies already allowed to be provided with ESH. The proposal was generated as a result of discussions during the Active Shooter and Hostile Threats in Public Buildings - Study Group, convened pursuant to the aforementioned bills. For more information on the Study Group activities and discussions, please see attached Study Group Report.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
While the proposal does not increase the resiliency of buildings, arguments could be made that the resiliency of building occupants could be increased against active shooter or hostile threats events. Conversely, it could also be claimed that the resiliency of occupants could be reduced by enabling assailants to lock occupants in a given room and prevent first responders from entering. 

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal intends to **allow** the installation of ESH in public buildings, it does not **mandate** such. Should the building owner(s) decide to install ESH, the proposal could reduce or increase the cost of construction, depending upon the type of locking devices selected.

Attached Files

- **20220407 Active Sh. and Hostile Threats in Pub.pdf**
<https://va.cdpaccess.com/proposal/1012/1448/files/download/629/>

B108.1-18

VCC: 108.1, 110.1, 110.1.1 (New), (New); IBC®: 1010.1.4.4, 1010.1.4.4.1, 1010.1.9, 1010.1.9.1, 1010.1.9.2, 1010.1.9.4, 1010.1.9.5, 1010.1.9.6, 1010.1.9.8, 1103.2, 1103.2.15 (New); VFC: (New); IFC®: 404.2.3, 404.2.3.1, 404.2.3.2, 406.4.1 (New), 1001.4 (New), [BE] 1010.1.9; VFC: (N) 1010.1.9.3; IFC®: 1031.2, 1031.2.1; VFC: 1031.10 (New)

Proponents: DHCD Staff on behalf of the following stakeholders represented at the School Safety Subworkgroup: Virginia Building & Code Officials Association; Virginia Department of Education; Augusta County Public Schools; American Institute of Architects (AIA) Virgi

2015 Virginia Construction Code

108.1 When applications are required.. Application for a permit shall be made to the building official and a permit shall be obtained prior to the commencement of any of the following activities, except that applications for emergency *construction*, alterations or *equipment* replacement shall be submitted by the end of the first *working day* that follows the day such work commences. In addition, the building official may authorize work to commence pending the receipt of an application or the issuance of a permit.

1. *Construction* or demolition of a *building* or *structure*. Installations or alterations involving (i) the removal or addition of any wall, partition or portion thereof; (ii) any structural component; (iii) the repair or replacement of any required component of a fire or smoke rated assembly; (iv) the alteration of any required means of egress system including the addition of emergency supplemental hardware; (v) water supply and distribution system, sanitary drainage system or vent system; (vi) electric wiring; (vii) fire protection system, mechanical systems, or fuel supply systems; or (viii) any equipment regulated by the USBC.
2. For change of occupancy, application for a permit shall be made when a new certificate of occupancy is required by the VEBC.
3. Movement of a lot line that increases the hazard to or decreases the level of safety of an existing building or structure in comparison to the building code under which such building or structure was constructed.
4. Removal or disturbing of any asbestos containing materials during the construction or demolition of a building or structure, including additions.

110.1 Approval and issuance of permits.. The building official shall examine or cause to be examined all applications for permits or amendments to such applications within a reasonable time after filing. If the applications or amendments do not comply with the provisions of this code or all pertinent laws and ordinances, the permit shall not be issued and the permit applicant shall be notified in writing of the reasons for not issuing the permit. If the application complies with the applicable requirements of this code, a permit shall be issued as soon as practicable. The issuance of permits shall not be delayed in an effort to control the pace of *construction* of new detached one- or two-family dwellings.

Add new text as follows:

1 110.1.1 New Code Section Consultation and notification.. Prior to approval of *emergency supplemental hardware*, the building code official shall consult with the local fire code official or state fire code official if no local fire code official exists, and head of the local law enforcement agency. The local fire code official, the state fire code official, and the local fire, EMS and law enforcement first responders shall be notified of such approval, after approval of such *emergency supplemental hardware* by the building code official.

1 New Code Section EMERGENCY SUPPLEMENTAL HARDWARE.. Any *approved hardware* used only for emergency events or drills to keep intruders from entering the room during an active shooter or hostile threat event or drill.

2018 International Building Code

1010.1.4.4 Locking arrangements in educational occupancies.. In Group E occupancies, except Group E day care facilities, and Group B educational occupancies, egress-exit access doors from classrooms, offices and other occupied rooms ~~shall, except for exit doors and doors across corridors, shall~~ be permitted to be provided with locking arrangements designed to keep intruders from entering the room emergency supplemental hardware where all of the following conditions are met:

1. The door shall be capable of being ~~unlocked~~ opened from outside the room with a key, proprietary device provided by the manufacturer, or other approved means.
2. The door shall be openable from within the room in accordance with Section 1010.1.9, except emergency supplemental hardware is not required to comply with Chapter 11.

NOTE: School officials should consult with their legal counsel regarding provisions of the Americans with Disabilities Act and any other applicable requirements.

3. Installation of emergency supplemental hardware on fire door assemblies must comply with Section 716.2. Modifications shall not be made to listed panic hardware, fire door hardware or door closers.
4. The emergency supplemental hardware shall not be capable of being used on other doors not intended to be used and shall at least one component that requires modification to, or is permanently affixed to, the surrounding wall, floor, door and/or frame assembly construction for it to properly function.

5. Employees shall engage in lockdown training procedures on how to deploy and remove the emergency supplemental hardware and its use shall be incorporated in the approved lockdown plan complying with the SFPC.
6. The emergency supplemental hardware and its components shall be maintained in accordance with the SFPC.
7. Approved emergency supplemental hardware shall be of consistent type throughout a building.
Exception: The building official may approve alternate types of emergency supplemental hardware in accordance with Section 110.1 when a consistent device cannot be installed.

1010.1.4.4.1 Remote operation of locks.. Remote operation of locks complying with Section 1010.1.4.4 shall be permitted.

1010.1.9 Door operations.. Except as specifically permitted by this section, egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort.

Exception : Emergency supplemental hardware provided in accordance with Section 1010.1.4.4.

1010.1.9.1 Hardware.. Door handles, pulls, latches, locks and other operating devices on doors required to be *accessible* by Chapter 11 shall not require tight grasping, tight pinching or twisting of the wrist to operate.

Exception. Emergency supplemental hardware provided in accordance with Section 1010.1.4.4.

1010.1.9.2 Hardware height.. Door handles, pulls, latches, locks and other operating devices shall be installed 34 inches (864 mm) minimum and 48 inches (1219 mm) maximum above the finished floor. Emergency supplemental hardware provided in accordance with Section 1010.1.4.4. shall be installed 48 inches (1219 mm) maximum above the finished floor. Locks used only for security purposes and not used for normal operation are permitted at any height.

Exception: Access doors or gates in barrier walls and fences protecting pools, spas and hot tubs shall be permitted to have operable parts of the latch release on self-latching devices at 54 inches (1370 mm) maximum above the finished floor or ground, provided that the self-latching devices are not also self-locking devices operated by means of a key, electronic opener or integral combination lock.

1010.1.9.4 Locks and latches.. Locks and latches shall be permitted to prevent operation of doors where any of the following exist:

1. Places of detention or restraint.
2. In buildings in occupancy Group A having an *occupant load* of 300 or less, Groups B, F, M and S, and in *places of religious worship*, the main door or doors are permitted to be equipped with key-operated locking devices from the egress side provided:
 - 2.1. The locking device is readily distinguishable as locked.
 - 2.2. A readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED WHEN THIS SPACE IS OCCUPIED. The sign shall be in letters 1 inch (25 mm) high on a contrasting background.
 - 2.3. The use of the key-operated locking device is revocable by the *building official* for due cause.
3. Where egress doors are used in pairs, *approved* automatic flush bolts shall be permitted to be used, provided that the door leaf having the automatic flush bolts does not have a doorknob or surface-mounted hardware.
4. Doors from individual *dwelling* or *sleeping units* of Group R occupancies having an *occupant load* of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.
5. *Fire doors* after the minimum elevated temperature has disabled the unlatching mechanism in accordance with *listed fire door* test procedures.
6. Doors serving roofs not intended to be occupied shall be permitted to be locked preventing entry to the building from the roof.
7. Egress doors equipped with *emergency supplemental hardware* complying with Section 1010.1.4.4. from the egress side provided:
 - 7.1. A readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS HARDWARE SHALL BE USED BY AUTHORIZED PERSONNEL ONLY. The sign shall be in letters 1 inch (25 mm) high on a contrasting background.
 - 7.2. The use of the *emergency supplemental hardware* is revocable by the building official or fire official for due cause.

1010.1.9.5 Bolt locks.. Manually operated flush bolts or surface bolts are not permitted.

Exceptions:

1. On doors not required for egress in individual *dwelling units* or *sleeping units*.
2. Where a pair of doors serves a storage or equipment room, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf.
3. Where a pair of doors serves an *occupant load* of less than 50 persons in a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf. The inactive leaf shall not contain doorknobs, *panic* bars or similar operating

4. ^{hardware.} Where a pair of doors serves a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf provided that such inactive leaf is not needed to meet egress capacity requirements and the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1. The inactive leaf shall not contain doorknobs, *panic* bars or similar operating hardware.
5. Where a pair of doors serves patient care rooms in Group I-2 occupancies, self-latching edge- or surface-mounted bolts are permitted on the inactive leaf provided that the inactive leaf is not needed to meet egress capacity requirements and the inactive leaf shall not contain doorknobs, *panic* bars or similar operating hardware.
6. Emergency supplemental hardware provided in accordance with Section 1010.1.4.4.

1010.1.9.6 Unlatching.. The unlatching of any door or leaf shall not require more than one operation.

Exceptions:

1. Places of detention or restraint.
2. Where manually operated bolt locks are permitted by Section 1010.1.9.5.
3. Doors with automatic flush bolts as permitted by Section 1010.1.9.4, Item 3.
4. Doors from individual *dwelling units* and *sleeping units* of Group R occupancies as permitted by Section 1010.1.9.4, Item 4.
5. One additional operation shall be permitted for release of *emergency supplemental hardware* provided in accordance with Section 1010.1.4.4.

1010.1.9.8 Delayed egress.. Delayed egress locking systems shall be permitted to be installed on doors serving the following occupancies in buildings that are equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or an *approved automatic smoke or heat detection system* installed in accordance with Section 907.

1. Group B, F, I, M, R, S and U occupancies.
2. Group E classrooms with an *occupant load* of less than 50.

~~Exception~~ Exceptions:

1. Delayed egress locking systems shall be permitted to be installed on exit or *exit access* doors, other than the main exit or *exit access* door, serving a courtroom in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
2. Emergency supplemental hardware shall not be considered a delayed egress locking system.

1103.2 General exceptions.. *Sites*, buildings, *structures*, *facilities*, elements and spaces shall be exempt from this chapter to the extent specified in this section.

Add new text as follows:

1 1103.2.15 New Code Section Emergency supplemental hardware.. In Group E occupancies, except Group E day care facilities, and Group B educational occupancies, when *emergency supplemental hardware* is deployed during an active shooter or hostile threat event and provided in accordance with Section 1010.1.4.4.

2015 Virginia Statewide Prevention Fire Code

Add new text as follows:

1 New Code Section EMERGENCY SUPPLEMENTAL HARDWARE.. Any *approved* hardware used only for emergency events or drills to keep intruders from entering the room during an active shooter or hostile threat event or drill.

2018 International Fire Code

404.2.3 Lockdown plans.. Lockdown plans shall only be permitted where such plans are approved by the *fire code official* and are in compliance with Sections 404.2.3.1 and 404.2.3.2.

404.2.3.1 Lockdown plan contents.. Lockdown plans shall include the following:

1. Identification of individuals authorized to issue a lockdown order.
2. Security measures used during normal operations, when the building is occupied, that could adversely affect egress or fire department operations.

3. A description of identified emergency and security threats addressed by the plan, including specific lockdown procedures to be implemented for each threat condition.
4. Means and methods of initiating a lockdown plan for each threat, including:
 - 4.1. The means of notifying occupants of a lockdown event, which shall be distinct from the fire alarm signal.
 - 4.2. Identification of each door or other access point that will be secured.
 - 4.3. A description of the means or methods used to secure doors and other access points.
 - 4.4. A description of how locking means and methods are in compliance with the requirements of the VCC and the applicable provisions of this code for egress and accessibility.
5. Procedures for reporting to the fire department any lockdown condition affecting egress or fire department operations.
6. Procedures for determining and reporting the presence or absence of occupants to emergency response agencies during a lockdown.
7. Means for providing two-way communication between a central location and each area subject to being secured during a lockdown.
8. Identification of the prearranged signal for terminating the lockdown.
9. Identification of individuals authorized to issue a lockdown termination order.
10. Procedures for unlocking doors and verifying that the means of egress has been returned to normal operations upon termination of the lockdown.
11. Training procedures and frequency of lockdown plan drills.

404.2.3.2 Drills. Lockdown plan drills shall be conducted in accordance with the approved plan. Such drills shall not be substituted for fire and evacuation drills required by Section 405.2.

Add new text as follows:

1 406.4.1 New Code Section Emergency supplemental hardware training. Where a facility has installed approved emergency supplemental hardware, employees shall be trained on their assigned duties and procedures for the use of such device. Records of in-service training shall be made available to the fire code official upon request.

1 1001.4 New Code Section Unauthorized use of emergency supplemental hardware. No person shall utilize any *approved emergency supplemental hardware* to prevent the ingress or egress from any occupied space.

Exceptions:

1. Utilized by authorized persons or other persons occupying such space in the event of any actual or perceived hostile threat or active shooter event.
2. Utilized in conjunction with any approved lockdown drill requiring the utilization of the approved *emergency supplemental hardware*.
3. Utilization for the testing, use and training by emergency response personnel.

Where such device is utilized in accordance with the Exceptions 1 through 3 above, the hardware device shall be removed immediately following the conditions of such exceptions.

[BE] 1010.1.9 Door operations. Except as specifically permitted by this section or the applicable building code, egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort.

2015 Virginia Statewide Prevention Fire Code

(N) 1010.1.9.3 Locks and latches. Where required, a readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED WHEN THIS SPACE IS OCCUPIED. The sign shall be in letters 1 inch (25 mm) high on a contrasting background ~~and shall be maintained.~~ Emergency supplemental hardware provided in accordance with the applicable building code shall be provided a readily visible durable sign posted on the egress side on or adjacent to the door stating: THIS HARDWARE SHALL BE USED BY AUTHORIZED PERSONNEL ONLY. The sign shall be in letters 1 inch (25 mm) high on a contrasting background.

2018 International Fire Code

1031.2 Reliability. ~~Required~~ Unless otherwise permitted by the applicable building code, required *exit accesses, exits* and *exit discharges* shall be continuously maintained free from obstructions or impediments to full instant use in the case of fire or other emergency where the building area served by the *means of egress* is occupied. An *exit* or *exit passageway* shall not be used for any purpose that interferes with a *means of egress*.

1031.2.1 Security devices and egress locks. Security devices, excluding emergency supplemental hardware, affecting *means of egress* shall be subject to approval of the *fire code official*. Security devices and locking arrangements in the *means of egress* that restrict, control, or delay egress

shall be installed and maintained as required by this ~~chapter~~ chapter or as otherwise permitted under the applicable building code.

2015 Virginia Statewide Prevention Fire Code

Add new text as follows:

1 1031.10 New Code Section Maintenance of emergency supplemental hardware. *Emergency supplemental hardware shall be installed in accordance with the applicable building code and shall be maintained in accordance with this code and the manufacturer's instructions. The fire code official shall be authorized to direct the practical application of any such hardware device to ensure the device operates as designed, and is free from any defects, damage, or conditions which may restrict the deployment and removal of such hardware device.*

Reason Statement: This proposal allows limited types of barricade door devices in Group E and B educational occupancies only, by "taking over" the current 2018 IBC language and adding exceptions to the various door-related requirements to allow such hardware. A barricade door device would not necessarily need to go through the code modification process in accordance with VCC 106.3, unless it was a type that did not comply with the "openable from outside," limited height above finished floor requirements, and has a fixed component to function, among others.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction

B1010.2.8-21

VCC: Section 108.1, 110.1.1, SECTION 202, 1010.1.4.4, 1103.2.15; VFC: 1031.11

Proponents: DHCD Staff on behalf of the following stakeholders represented at the Active Shooter and Hostile Threat Events in Public Buildings Study Group: Virginia Building & Code Officials Association, Virginia Fire Prevention Association, Nightlock

2018 Virginia Construction Code

Revise as follows:

Section 108.1 When applications are required. Application for a permit shall be made to the *building official* and a permit shall be obtained prior to the commencement of any of the following activities, except that applications for emergency *construction*, alterations or *equipment* replacement shall be submitted by the end of the first *working day* that follows the day such work commences. In addition, the *building official* may authorize work to commence pending the receipt of an application or the issuance of a permit.

1. *Construction* or demolition of a *building* or *structure*. Installations or alterations involving (i) the removal or addition of any wall, partition or portion thereof, (ii) any structural component, (iii) the repair or replacement of any required component of a fire or smoke rated assembly, (iv) the alteration of any required means of egress system, including the addition or removal of *emergency supplemental hardware*, (v) water supply and distribution system, sanitary drainage system or vent system, (vi) electric wiring, (vii) fire protection system, mechanical systems, or fuel supply systems, or (viii) any *equipment* regulated by the USBC.
2. For *change of occupancy*, application for a permit shall be made when a new certificate of occupancy is required by the VEBC.
3. Movement of a *lot line* that increases the hazard to or decreases the level of safety of an existing *building* or *structure* in comparison to the *building code* under which such *building* or *structure* was constructed.
4. Removal or disturbing of any asbestos containing materials during the *construction* or demolition of a *building* or *structure*, including additions.

110.1.1 Consultation and notification. Prior to approval or removal of *emergency supplemental hardware*, the building code official shall consult with the local fire code official, or state fire code official if no local fire code official exists, and head of the local law-enforcement agency. The local fire code official; the state fire code official; and the local fire, EMS, and law-enforcement first responders shall be notified by the building code official of such approval or removal. ~~after approval or removal of such *emergency supplemental hardware* by the building code official.~~

SECTION 202 DEFINITIONS. "Public Building" - a structure or building that is owned, leased, or otherwise occupied by a municipality or the state and used for any municipal or public purposes by the municipality or the state.

~~1010.1.4.4~~ **1010.2.8 Locking arrangements in educational occupancies** **Emergency Supplemental Hardware.** In Group E occupancies, except Group E day care facilities, ~~and~~ Group B educational occupancies and public buildings, *exit access doors* from classrooms, offices, and other occupied rooms, except for exit doors and doors across corridors, shall be permitted to be provided with *emergency supplemental hardware* where all of the following conditions are met:

1. The door shall be capable of being opened from outside the room with a key, proprietary device provided by the manufacturer, or other *approved* means.
2. The door shall be openable from within the room in accordance with Section 1010.1.9, except *emergency supplemental hardware* is not required to comply with Chapter 11.

Note: School officials and building owners should consult with their legal counsel regarding provisions of the Americans with Disabilities Act of 1990 (42 USC § 12101 et seq.) and any other applicable requirements.

3. Installation of *emergency supplemental hardware* on fire door assemblies must comply with Section 716.2. Modifications shall not be made to listed *panic hardware*, fire door *hardware*, or door closures.
4. The *emergency supplemental hardware* shall not be capable of being used on other doors not intended to be used and shall have at least one component that requires modification to, or is permanently affixed to, the surrounding wall, floor, door, or frame assembly *construction* for it to properly function.
5. Employees shall engage in lockdown training procedures on how to deploy and remove the *emergency supplemental hardware*, and its use shall be incorporated in the *approved* lockdown plan complying with the SFPC.
6. The *emergency supplemental hardware* and its components shall be maintained in accordance with the SFPC.
7. *Approved emergency supplemental hardware* shall be of consistent type throughout a building.

Exception: The *building official* may approve alternate types of *emergency supplemental hardware* in accordance with Section 110.1 when a consistent device cannot be installed.


1103.2.15 Emergency supplemental hardware. In Group E occupancies, except Group E day care facilities, ~~and~~ Group B educational occupancies, and public buildings, when *emergency supplemental hardware* is deployed during an active shooter or hostile threat event and provided in accordance with Section ~~1010.1.4.4.~~ 1010.2.8, is not required to comply with this chapter.

2018 Virginia Statewide Fire Prevention Code

Revise as follows:

1031.11 Emergency supplemental hardware. *Emergency supplemental hardware* shall be installed in accordance with the *applicable building code* and shall be *maintained* in accordance with this code, the conditions of its approval and the manufacturer's instructions. The *fire code official* shall be authorized to revoke the use and storage of *emergency supplemental hardware* within a *building* for due cause based on failure to comply with requirements in this code or the *applicable building code*. Revocations shall be rescinded upon achieving compliance with this code and the *applicable building code*.

Reason Statement: The proposal intends to comply with the SB 333 and HB 670 by expanding on the existing provisions for ESH. The gist of the proposal is the addition of "public buildings" to the list of uses/occupancies already allowed to be provided with ESH. The proposal was generated as a result of discussions during the Active Shooter and Hostile Threats in Public Buildings - Study Group, convened pursuant to the aforementioned bills. For more information on the Study Group activities and discussions, please see attached Study Group Report.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
While the proposal does not increase the resiliency of buildings, arguments could be made that the resiliency of building occupants could be increased against active shooter or hostile threats events. Conversely, it could also be claimed that the resiliency of occupants could be reduced by enabling assailants to lock occupants in a given room and prevent first responders from entering. 

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal intends to **allow** the installation of ESH in public buildings, it does not **mandate** such. Should the building owner(s) decide to install ESH, the proposal could reduce or increase the cost of construction, depending upon the type of locking devices selected.

B1020.2.1-21

IBC: 1020.2.1

Proponents: Christopher Campbell

2021 International Building Code - Second Printing

Delete without substitution:

~~1020.2.1 Hoistway opening protection.~~ Elevator hoistway openings shall be protected in accordance with Section 3006.2.1.

Reason Statement: The VCC has historically eliminated the requirement for hoistway opening protection in 3006. As long as that section is eliminated in the 2021 VCC, the reference to 3006 from 1020 is invalid.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is simply removing an invalid reference created by the removal of Section 3006, part of a separate code change.

B1026.2-21

VCC: 1026.2

Proponents: Jane Kim (jane.kim2@fairfaxcounty.gov)

2018 Virginia Construction Code

Revise as follows:

1026.2 Separation. The separation between *buildings* or refuge areas connected by a *horizontal exit* shall be provided by a fire wall complying with Section 706, by a *fire barrier* complying with Section 707 or a horizontal assembly complying with Section 711, or by both. The minimum *fire-resistance rating* of the separation shall be two hours. Opening protectives in *horizontal exits* shall also comply with Section 716. Duct and air transfer openings in a *fire wall* or *fire barrier* that serves as a *horizontal exit* shall also comply with Section 717. The *horizontal exit* separation shall extend vertically through all levels of the building unless floor assemblies have a *fire-resistance rating* of not less than 2 hours. Openings in horizontal assemblies on the story served by *horizontal exits* shall be protected in accordance with Sections 712.1.1, 712.1.3, ~~712.1.13, and 712.1.13~~ or Item 4 of Section 1019.3.

Exception: A *fire-resistance rating* is not required at *horizontal exits* between a *building area* and an above-grade pedestrian walkway constructed in accordance with Section 3104, provided that the distance between connected buildings is more than 20 feet (6096 mm). Horizontal exits constructed as fire barriers shall be continuous from exterior wall to exterior wall as to divide completely the floor served by the horizontal exit.

Reason Statement: Proposed change is to correct the change made at last code development cycle to this section. Protection requirement is for opening in refuge area acting as an exit enclosure. Draft stop do not provide equivalent protection required for fire resistance rated exit enclosure. The correction further clarifies requirements for opening protective provided is equivalent to fire rated floor assembly of the refuge area. Following is the reasons statement provided in the previous code development cycle. "The change will clarify and ensure protection is provided for increased number of occupants in refuge compartment at each story served by horizontal exit. Current text of Section 1026.2 is unclear in addressing unprotected floor opening or unclosed exit access stairways and ramps communicating not more than two stories as permitted in Section 712.1.9 item1 and 1019.3 item 1. Unprotected opening will not contain fire or smoke within the horizontal exit compartment where fire originated from and will reduce the protection of the occupants taking refuge in the protected compartment. Proposed change will ensure safety of occupants taking refuge in protected compartment as intended. "

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction -

EB102.2.1-21

VEBC: 102.2.1, 103.2

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2018 Virginia Existing Building Code

Revise as follows:

102.2.1 Change of occupancy to Group I-2 or I-3 applicability. ~~A change of occupancy to Group I-2 or I-3 from another occupancy classification shall comply with the provisions of the VCC as required for new construction, not chapter 7 of this code. All other provisions of the VEBC, including change of occupancy within an existing Group I-2 or I-3 classification, are applicable to Group I-2 or I-3. Written application shall be made to the local building department for a new certificate of occupancy, and the new certificate of occupancy shall be obtained prior to the change of occupancy. When impractical to achieve compliance with the VCC for the new occupancy classification, the building official shall consider modifications upon application and as provided for in Section 106.3 of the VCC.~~

103.2 Change of occupancy. ~~A Building or structure undergoing a change of occupancy shall comply with the provisions of this code for change of occupancy except as provided for in Section 102.2.1 for Group I-2 or I-3. Permitting, inspections and certificate of occupancy issuance shall be in accordance with the administrative provisions of the VCC. Prior to a change of occupancy of the building or structure, the owner or the owner's agent shall make written application to the local building department for a new certificate of occupancy and shall obtain the new certificate of occupancy. When impractical to achieve compliance with this code for the new occupancy, the building official shall consider modifications upon application and as provided for in Section 106.3 of the VCC.~~

Reason Statement: The provisions of 102.2.1 regarding when to use the VCC verses when to use the VEBC are incomplete. The proposed code change clarifies when to bypass the VEBC and when to use the VEBC when an I-2 or I-3 is involved. The intent is to use the VEBC for I-2 or I-3 except in the case of a change of occupancy to one of the uses, but that is not clear in Section 102.2.1. As an example, if you have a change of occupancy where a group B building, or portion of a building, changes to I-2, 102.2.1 should clearly send you directly to the VCC bypassing VEBC chapter 7. If you have a change of occupancy within and existing I-2, without a change of classification to I-2, such as an existing I-2 occupant load increase to require additional plumbing fixtures, the VEBC should apply.

The second sentence of 102.2.1 is proposed for deletion since this is addressed in VCC Chapter 1. Section 103.2 states prior to a change of occupancy written application for a new CO is required but does not mention compliance with the change of occupancy provisions of the VEBC are required. This corrects the error and references the administrative provisions of the VCC for permits, inspections, and CO issuance.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change is editorial so there is no cost impact.

EB603.6-21

VEBC: 603.6


Proponents: Ronald Clements (clementsro@chesterfield.gov)

2018 Virginia Existing Building Code

Delete without substitution:

~~**603.6 Plumbing.** Where the occupant load of the story is increased by more than 20 percent, plumbing *fixtures* for the story shall be provided in quantities specified in the *International Plumbing Code* based on the increased occupant load.~~

Reason Statement: Any occupant load change that increases the number of required plumbing fixtures is a change of occupancy by definition and section 710.1 is applicable. This provision is not consistent with the exception to 710.1 creating a confusing conflict.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This section is already overridden by section 710.1 so this is effectively editorial.

EB701.1-21

VEBC: 701.1, 1401.1, 1401.2, 1401.2.1 (New), 1401.3, 1401.4, 1401.5, 1402.1, 1402.1.1, 1402.1.2, 1402.1.3, 1402.2 (New), 1402.2.1 (New), 1402.2.2 (New), 1402.2, 1402.3

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2018 Virginia Existing Building Code

Revise as follows:

701.1 Scope. The provisions of this chapter shall apply where a *change of occupancy* occurs, except as modified by Section 906 for *historic buildings*. Compliance with the current VCC for the *change of occupancy* shall only be required as prescribed in this chapter. Compliance shall be only as necessary to meet the specific provisions of the applicable International Codes and is not intended to require the entire *building* be brought into compliance.

Exception: ~~Compliance with the provisions of Chapter 14 shall be permitted in as a compliance alternative to lieu of complying with this chapter for a *change of occupancy*.~~ Compliance with the provisions of Chapter 14 shall be permitted in as a compliance alternative to lieu of complying with this chapter for a *change of occupancy* to buildings that will not continue to be or are proposed to be Institutional Group I occupancies, High-Hazard Group H occupancies, or Residential Group R-5

1401.1 Scope. The provisions of this chapter ~~are~~ are applicable when the exception to Section 701.1 is applied intended to maintain or increase the current degree of public safety, health, and general welfare in *existing buildings or structures*, while permitting changes of occupancy without requiring full compliance with Chapter 7, except where compliance with other provisions of this code is specifically required in this chapter.

Exception: The provisions of this chapter shall not apply to *buildings* with occupancies in Group H or I.

1401.2 Complete change- Change of occupancy. ~~The *change of occupancy* shall be evaluated in accordance with the evaluation process specified in Sections 1402 through 1404. Where an entire *existing building* undergoes a *change of occupancy*, the applicable provisions of this chapter for the new occupancy shall be used to determine compliance with this code.~~

Exception: Plumbing, mechanical and electrical systems in *buildings* undergoing a *change of occupancy* shall be subject to any applicable requirements of Chapter 7.

Add new text as follows:

1401.2.1 Plumbing, mechanical, and electrical systems. Plumbing, mechanical, and electrical systems shall conform to the applicable requirements of Sections 708, 709, and 710.

Revise as follows:

1401.3 Partial Work undertaken in connection with a change of occupancy. Any repairs, alterations, or additions undertaken in connection with a change of occupancy shall conform to the applicable requirements of this code for the work as classified in this code and as modified by this chapter.

Where a portion of the *building* undergoes a *change of occupancy* and that portion is separated from the remainder of the *building* with fire barrier or horizontal assemblies having a fire resistance rating as required by Table 508.4 of the VCC or Section R302 of the *International Residential Code* for the separate occupancies, or with approved compliance alternatives, the portion changed shall be made to conform to the provisions of this chapter.

Where a portion of the *building* undergoes a *change of occupancy* and that portion is not separated from the remainder of the *building* with fire barriers or horizontal assemblies having a fire resistance rating as required by Table 508.4 of the VCC or Section R302 of the *International Residential Code* for the separate occupancies, or with approved compliance alternatives, the provisions of this chapter which apply to each occupancy shall apply to the entire *building*. Where there are conflicting provisions, those requirements that are the most restrictive shall apply to the entire *building or structure*.

Delete without substitution:

1401.4 Accessibility requirements. All portions of the *building* proposed for a *change of occupancy* shall conform to the applicable accessibility provisions of Chapter 4.

1401.5 Compliance with flood hazard provisions. In flood hazard areas, *buildings or structures* that are evaluated in accordance with this chapter shall comply with Section 1612 of the VCC or Section R322 of the VRC, as applicable, if the work covered by this chapter constitutes *substantial improvement*.

Revise as follows:

1402.1 Evaluation process. The evaluation process specified herein shall be followed in its entirety to evaluate *existing buildings* for work covered by this chapter. The *existing building* shall be evaluated in accordance with the provisions of this section and Sections 1403 and ~~1401.4~~ 1404. The

evaluation shall be comprised of three categories as described in Sections 1402.1.1 through 1402.1.3.

1402.1.1 Fire safety. Included within the fire safety category are the structural fire resistance, automatic fire detection, fire alarm, automatic sprinkler system and fire suppression system features of the facility.

1402.1.2 Means of egress. Included within the means of egress category are the configuration, characteristics and support features for means of egress in the facility.

1402.1.3 General safety. Included within the general safety category are the fire safety parameters and the means-of-egress parameters.

Add new text as follows:

1402.2 Occupancy basis. The evaluation of the building per this chapter shall be based on the new occupancy. A partial building change of occupancy shall be evaluated accordance with Section 1402.2.1 or 1402.2.2 as applicable.

1402.2.1 Separated change of occupancy. Where a portion of the building undergoes a change of occupancy and that portion is separated from the remainder of the building in accordance with Section 508.4 of the VCC, only the portion of building undergoing the change of occupancy shall conform to the provisions of this chapter based on the new occupancy classification.

1402.2.2 Nonseparated change of occupancy. Where a portion of the building undergoes a change of occupancy and that portion is not separated from the remainder of the building in accordance with Section 508.4 of the VCC, the provisions of this chapter shall apply to the entire building based on all the occupancy classifications in the building.

Revise as follows:

~~1402.2~~ **1402.3 Structural evaluation.** The *existing building* shall be evaluated to determine adequacy of the existing structural systems for the proposed *change of occupancy*. The evaluation shall demonstrate that the *existing building* with the work completed is capable of resisting the loads specified in Chapter 16 of the VCC.

~~1402.3~~ **1402.4 Submittal.** The results of the evaluation as required in Section 1402.1 shall be submitted to the *code official*. Table 1404.1 shall be utilized for tabulating the results of the evaluation. References to other sections of this code indicate that compliance with those sections is required in order to gain credit in the evaluation herein outlined.


Reason Statement: This code change is a continuation of the clean-up editorial work that has been done each code cycle to incrementally make this section less confusing and easier to use.

707.1- The prohibition on using Chapter 14 for group I and H has been incorporated into the scoping of the exception in Chapter 7 that allows use of Chapter 14 as an alternative. Group R-5 has been included with groups H and I in being outside the scope of Chapter 14 since this chapter was not set up for structures designed per the IRC.

1401.1- The revision to this section removes commentary style language, simplifies the scoping provision, and ties back to the applicability, which comes from the exception to Section 701.1.

1401.2 through 1401.4- The distinction between full and partial building change of occupancy is proposed to be addressed in section 1402.2. 1401.1 is proposed to be a more accurate scoping section stating the evaluation shall be done per 1402 through 1404; stating, rather than using an exception, that plumbing/mechanical and electrical work must be addressed with chapter 7 provisions; providing for work undertaken in connection with a change of occupancy, which is currently not addressed in Chapter 14; deleting the flood provisions since those are not driven by a change of occupancy and are addressed through the work undertaken in connection with a change of occupancy section; and deleting the provisions in 1401.4 for accessibility since there are no longer change of occupancy based accessibility provisions in chapter 4.

1402.1 through 1402.4- This section starts out establishing that the evaluation is based on the new occupancy and then addresses how to handle partial change of occupancy with the sub-sections. This maintains the method used in 2018 based on separation provisions of VCC 508.4.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that will not affect construction cost.

EB707.2-21

VEBC: 707.2

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2018 Virginia Existing Building Code

Revise as follows:

707.2 Exterior wall rating for change of occupancy classification to a higher hazard category. When a *change of occupancy* classification is made to a higher hazard category as shown in Table 707.1, exterior walls shall have fire resistance and exterior opening protectives as required by the VCC.

~~**Exception:** A two-hour fire resistance rating shall be allowed where the *building* does not exceed three stories in height and is classified as one of the following groups: A-2 and A-3 with an occupant load of less than 300, B, F, M or S.~~

Reason Statement: The exception is never applicable because the listed occupancies are never required to have a rating greater than 2 hours. This error is even noted in the ICC commentary for this section (1011.6.1 in the IEBC).

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal removes and moots an exception so it will not affect cost.

EC-C402.4-21

VCC: 1301.1.1.1, TABLE C402.4, TABLE C402.4.3

Proponents: Eric Lacey (eric@reca-codes.com); Energy Sub-Workgroup

2018 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the International Energy Conservation Code (IECC). The following changes shall be made to the IECC:

1. Add Sections C402.1.4.2, C402.1.4.2.1, C402.1.4.2.2, C402.1.4.2.3, C402.2.1.2, C402.2.1.3, C402.2.1.4, C402.2.1.5 and Change Section C402.2.1.1 to read:

C402.1.4.2 Roof/ceiling assembly. The maximum roof/ceiling assembly *U*-factor shall not exceed that specified in Table C402.1.4 based on *construction* materials used in the roof/ceiling assembly.

C402.1.4.2.1 Tapered, above-deck insulation based on thickness. Where used as a component of a maximum roof/ceiling assembly *U*-factor calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) for *U*-factor compliance as prescribed in Section C402.1.4.

C402.1.4.2.2 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly *U*-factor of the roof/ceiling *construction*.

C402.1.4.2.3 Multiple layers and staggered joints. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the *roof deck* at a gutter edge, roof drain or scupper.

C402.2.1 Roof assembly The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on *construction* materials used in the *roof assembly*.

C402.2.1.1 Tapered, above-deck insulation based on thickness. Where used as a component of a roof/ceiling assembly *R*-value calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value per inch (per mm) for *R*-value compliance as prescribed in Section C402.1.3.

C402.2.1.2 Minimum thickness, lowest point. The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be no less than 1 inch (25 mm).

C402.2.1.3 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (*R*-value) of roof insulation in roof/ceiling *construction*.

C402.2.1.4 Multiple layers and staggered joints. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the *roof deck* at a gutter edge, roof drain or scupper.

C402.2.1.5 Skylight curbs. Skylight curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-5, whichever is less.

Exception: Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

2. Change the SHGC for Climate Zone 4 (Except Marine) of Table C402.4 to read:

~~PF = A/B~~
3:

(Equation 4-5)

~~Where different windows or glass doors have different PF values, they shall each be evaluated separately.~~

~~Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.20, the required maximum projection shall be:~~

PF = Projection factor (decimal).

A = Distance measured horizontally from the farthest continuous extremity of any overhang, eave, or permanently attached shading

B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading

~~4.~~

5. Add an exception to the first paragraph of Section 403.7.7 to read:

Exception: Any grease duct serving a Type I hood installed in accordance with the *International Mechanical Code (IMC)* Section 506.3 shall not be required to have a motorized or gravity damper.

6. Add Section C403.2.2.1 to read:

C403.2.2.1 Dwelling unit mechanical ventilation. Mechanical ventilation shall be provided for *dwelling units* in accordance with the IMC.

7. Delete Section C403.7.5 and Table C403.7.5.
8. Delete Sections C404.5 through C404.5.2.1, including Tables.
9. Change Section C405.4 to read:

C405.4 Exterior lighting (Mandatory). All exterior lighting, other than low-voltage landscape lighting, shall comply with Section C405.4.1.

Exception: Where *approved* because of historical, safety, signage, or emergency considerations.

10. Change Section C502.1 to read:

C502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of Section 805 of the *Virginia Existing Building Code (VEBC)*.

11. Delete Sections C502.2 through C502.2.6.2.
12. Change Section C503.1 to read:

C503.1 General. Alterations to any *building or structure* shall comply with the requirements of Chapter 6 of the VEBC.

13. Delete Sections C503.2 through C503.6.
14. Change Section C504.1 to read:

C504.1 General. *Buildings and structures*, and parts thereof, shall be repaired in compliance with Section 510 of the VEBC.

15. Delete Section C504.2.

16. Change Section R401.2 to read:

R401.2 Compliance. Projects shall comply with all provisions of Chapter 4 labeled “Mandatory” and one of the following:

1. Sections R401 through R404.
2. Section R405.
3. Section R406.
4. The most recent version of REScheck, keyed to the 2018 IECC.

17. Change Section R401.3 to read:

R401.3 A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. Where *approved*, certificates for multifamily *dwelling units* shall be permitted to be located off-site at an identified location. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, basement walls, crawl space walls and floors, and ducts outside conditioned spaces; *U*-factors of fenestration and the solar heat gain coefficient (SHGC) of fenestration; and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling, and service water heating *equipment*. Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace,” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces, and electric baseboard heaters.

18. Change the wood frame wall *R*-value categories for Climate Zone 4 (Except Marine) in Table R402.1.2 to read:

19. Change the frame wall *U*-factor categories for Climate Zone 4 (Except Marine) in Table R402.1.4 to read:

20. Change Section R402.2.4 to read:

R402.2.4 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., *attics* and crawl spaces) shall be weatherstripped and insulated in accordance with the following values:

1. Hinged vertical doors shall have a minimum overall R-5 insulation value;
2. Hatches and scuttle hole covers shall be insulated to a level equivalent to the insulation on the surrounding surfaces; and
3. Pull down stairs shall have a minimum of 75 percent of the panel area having R-5 rigid insulation.

Access shall be provided to all *equipment* that prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened and to provide a permanent means of maintaining the installed *R*-value of the loose fill insulation.

21. Change Sections R402.4 and R402.4.1.1 to read:

R402.4 Air leakage. The *building* thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1.1 Installation (Mandatory). The components of the *building* thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer’s instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of *construction*. Where required by the code official, an *approved* third party shall inspect all components and verify compliance.

22. Change the title of the “Insulation Installation Criteria” category of Table R402.4.1.1; change the “Shower/tub on exterior wall” category of Table R402.4.1.1, and add footnotes “b” and “c” to Table R402.4.1.1 to read:

23. Change Section R402.4.1.2 to read:

R402.4.1.2 Testing. The *building* or *dwelling unit* shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in Climate Zone 4. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779, or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). A written report of the results of the test shall be signed by the party conducting the test and provided to the *building official*. Testing shall be conducted by a Virginia licensed general contractor, a Virginia licensed HVAC contractor, a Virginia licensed home inspector, a Virginia *registered design professional*, a certified BPI Envelope Professional, a certified HERS rater, or a certified duct and envelope tightness rater. The party conducting the test shall have been trained on the *equipment* used to perform the test. Testing shall be performed at any time after creation of all penetrations of the *building* thermal envelope.

Note: Should additional sealing be required as a result of the test, consideration may be given to the issuance of a temporary certificate of occupancy in accordance with Section 116.1.1.

During testing:

1. Exterior windows and doors and *fireplace* and stove doors shall be closed, but not sealed beyond the intended weatherstripping or other infiltration control measures;
2. Dampers, including exhaust, intake, makeup air, backdraft, and flue dampers, shall be closed, but not sealed beyond intended infiltration control measures;
3. Interior doors, if installed at the time of the test, shall be open;
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

24. Change Section R403.3.3 to read:

R403.3.3 Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exception: A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.

A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. The licensed mechanical contractor installing the mechanical system shall be permitted to perform the duct testing. The contractor shall have been trained on the equipment used to perform the test.

25. Delete Section R403.3.5.

26. Change Section R403.7 to read:

R403.7 Equipment and appliance sizing. Heating and cooling equipment and appliances shall be sized in accordance with ACCA Manual S or other *approved* sizing methodologies based on *building* loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies.

Exception: Heating and cooling equipment and appliance sizing shall not be limited to the capacities determined in accordance with Manual S or other *approved* sizing methodologies where any of the following conditions apply:

1. The specified equipment or appliance utilizes multistage technology or variable refrigerant flow technology and the loads calculated in accordance with the *approved* heating and cooling methodology fall within the range of the manufacturer's published capacities for that equipment or appliance.
2. The specified equipment or appliance manufacturer's published capacities cannot satisfy both the total and sensible heat gains calculated in accordance with the *approved* heating and cooling methodology and the next larger standard size unit is specified.
3. The specified equipment or appliance is the lowest capacity unit available from the specified manufacturer.

27. Change footnote "a" in Table R406.4 to read:

- a. When onsite renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2 and the building thermal envelope shall be greater than or equal to levels of energy efficiency and solar heat gain coefficient in Table R402.1.2, with a ceiling *R*-value of 49 and a wood frame wall *R*-value of 20 or 13 + 5, or Table R402.1.4, with a ceiling *U*-factor of 0.026 and a frame wall *U*-factor of 0.060.

28. Change Section R501.1 to read:

R501.1 Scope. The provisions of the *Virginia Existing Building Code* (VEBC) shall control the alteration, repair, addition and change of occupancy of existing *buildings* and *structures*.

29. Delete Sections R501.1.1 through R501.6.

30. Change Section R502.1 to read:

R502.1 General. Additions to an existing *building*, *building* system or portion thereof shall conform to the provisions of Section 811 of the VEBC.

31. Delete Sections R502.1.1 through R502.1.2.

32. Change Section R503.1 to read:

R503.1 General. Alterations to any *building* or *structure* shall comply with the requirements of Chapter 6 of the VEBC.

33. Delete Sections R503.1.1 through R503.2

34. Change Section R504.1 to read:

R504.1 General. *Buildings*, structures and parts thereof shall be repaired in compliance with Section 510 of the VEBC.

35. Delete Section R504.2.

TABLE C402.4 BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS

CLIMATE ZONE	4 EXCEPT MARINE
SHGC	0.36

TABLE C402.4.3 SHGC ADJUSTMENT MULTIPLIERS


PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATIONS
$0.2 \leq PF < 0.5$	1.1	1.2
$PF \geq 0.5$	1.2	1.6

Reason Statement: This proposal improves and simplifies the Virginia Construction Code by eliminating state-specific amendments that are either already incorporated in the 2021 IECC or are no longer necessary. While some of these modifications may have been necessary or reasonable at the time, we see no reason for Virginia to continue to diverge from the model code in these areas. The intent of this proposal is not to increase or decrease stringency by a meaningful amount, but rather to simplify and streamline the code adoption process going forward. This proposal deletes Section 1301.1.1 subsections 2, 3, and 4.

Subsections 2 and 4 were originally proposed by RECA in a previous code update to maintain Virginia's commercial fenestration SHGC provisions, which were more stringent than the model code at the time. The 2021 IECC is now essentially at the same level of stringency as Virginia (requiring 0.36 for fixed fenestration with no overhangs), but the 2021 IECC has simplified the process by eliminating the orientation-specific SHGC requirements in the prescriptive table. The IECC has incorporated a single SHGC for fixed fenestration (0.36); a lower SHGC for operable fenestration (0.33), and higher SHGC when the fenestration is accompanied by overhangs. These SHGC requirements are consistent with the values in ASHRAE Standard 90.1-2019, so that design professionals will not have two different sets of SHGC requirements to follow depending on which compliance option they select. Design professionals can still claim efficiency credit for favorable orientation, but would need to do so in the performance path where a full simulated performance analysis could be completed.

Subsection 3, which deals with increased skylight area with daylight responsive controls, has been revised and updated since this amendment was adopted into Virginia's code. The 2021 IECC now allows up to 6% skylight area where paired with daylight responsive controls (as compared to 5% in Virginia's UCC), and the sections related to skylights are more detailed. We see no reason for Virginia to continue to carry forward this amendment to the model code.

It is our intention that these portions of Virginia's code would be consistent with the IECC language in both the VCC and the VA Energy Conservation Code.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 
We do not expect this proposal to have any impact on resiliency.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal should not increase or decrease the costs of construction in a material way, but it should simplify the design process by bringing additional consistency between Virginia's commercial energy code requirements and the two model energy codes for commercial buildings.

EC-C403.7.7-21

VECC: C403.7.7

Proponents: Richard Grace (rgrace@culpepercounty.gov), VPMIA

2018 Virginia Energy Conservation Code

Revise as follows:

C403.7.7 Shutoff dampers (Mandatory). Outdoor air intake and exhaust openings and stairway and shaft vents shall be provided with Class I motorized dampers. The dampers shall have an air leakage rate not greater than 4 cfm/ft² (20.3 L/s • m²) of damper surface area at 1.0 inch water gauge (249 Pa) and shall be labeled by an approved agency when tested in accordance with AMCA 500D for such purpose.

Exception: ~~Any Where a grease duct serving a Type I hood is installed in accordance with IMC Section 506.3 shall not be required to have a motorized or gravity damper. dampers shall not be installed.~~

Outdoor air intake and exhaust dampers shall be installed with automatic controls configured to close when the systems or spaces served are not in use or during unoccupied period warm-up and setback operation, unless the systems served require outdoor or exhaust air in accordance with the *International Mechanical Code* or the dampers are opened to provide intentional economizer cooling.

Stairway and shaft vent dampers shall be installed with automatic controls configured to open upon the activation of any fire alarm initiating device of the building's fire alarm system or the interruption of power to the damper.


Exception: Nonmotorized gravity dampers shall be an alternative to motorized dampers for exhaust and relief openings as follows:

1. In buildings less than three stories in height above grade plane.
2. In buildings of any height located in *Climate Zones* 1, 2 or 3.
3. Where the design exhaust capacity is not greater than 300 cfm (142 L/s).

Nonmotorized gravity dampers shall have an air leakage rate not greater than 20 cfm/ft² (101.6 L/s • m²) where not less than 24 inches (610 mm) in either dimension and 40 cfm/ft² (203.2 L/s • m²) where less than 24 inches (610 mm) in either dimension. The rate of air leakage shall be determined at 1.0 inch water gauge (249 Pa) when tested in accordance with AMCA 500D for such purpose. The dampers shall be labeled by an approved agency.

Reason Statement: The current language does not prohibit motorized or gravity dampers from being installed in a grease duct. The language is more of a recommendation than a prohibition. "Shall not be required" is equivalent to "shall not be prohibited." VMC 506.3.7 states "duct systems serving a Type I hood shall be constructed and installed so that grease cannot collect in any portion thereof." Following that logic, VMC 506.3.11 states "fire dampers and smoke dampers shall not be installed in grease ducts." The ICC Commentary for IMC Section 503.11 states "Fire and smoke dampers are not compatible with grease ducts, and the duct enclosure requirements clearly account for the lack of such dampers where the ducts penetrate walls, floors and ceilings. Fire and smoke dampers would be made useless by the severe environment within grease ducts (e.g., high temperatures, grease, cleaning chemicals and water)." Motorized dampers, gravity dampers, backdraft dampers, barometric dampers, and any other type of damper that serves a purpose in a duct system would also be made useless by the severe environment within a grease duct.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency

I believe the original intent was to prohibit motorized and gravity dampers from being installed in a grease duct, therefore this is a clarification change rather than a technical change that has no effect on resiliency. 

Cost Impact: The code change proposal will not increase or decrease the cost of construction

I believe the original intent was to prohibit motorized and gravity dampers from being installed in a grease duct, there fore this is a clarification change rather than a technical change that would have an effect on cost.

EC-C1301.1.1-21

VCC: [E] 1301.1.1

Proponents: Matthew Benka (Matt@mdbstrategies.com); John Avis (avisj@avisconstruction.com)

2018 Virginia Construction Code

Revise as follows:

[E] 1301.1.1 Criteria. Buildings shall be designed and constructed in accordance with the *International Energy Conservation Code*.
Exception. Buildings with occupancy classifications of Factory Group F, Storage Group S or Utility and Miscellaneous Group U.

Reason Statement: The current energy code requirements are over burdensome for Factory Group F, Storage Group S, and Utility and Miscellaneous Group U. These use groups do not traditionally use a lot of energy as they are not heated or cooled to normal heating and cooling temperatures and or they create their own heat, etc. The change would eliminate unneeded and extra cost to the building owner. Additional insulation, roofing materials, and wall panel materials are being required in excess for buildings that will not fully utilized them. Many storage facilities are vacant most of the time and a lot of manufacturing and utility buildings will have the drive through doors open during production.

The General Assembly of Virginia enacted the following legislation in 2022.

HB 1289 Uniform Statewide Building Code; exemption for certain use and occupancy classifications.

1. § 1. That the Board of Housing and Community Development is directed to consider, during the next code development cycle, revising the Uniform Statewide Building Code (§ 36-97 et seq. of the Code of Virginia) to provide an exemption from any requirements in the energy efficiency standards established pursuant to 13VAC5-63-264 of the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, and any subsequent amendments to the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, for the following use and occupancy classifications pursuant to Chapter 3 of the 2018 Virginia Construction Code: (i) Section 306, Factory Group F; (ii) Section 311, Storage Group S; and (iii) Section 312, Utility and Miscellaneous Group U.



Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
This code change does not have an effect on the resiliency of buildings in terms of withstanding disasters.

Cost Impact: The code change proposal will decrease the cost of construction

The recent update to the *International Energy Conservation Code* causes undue hardship on building owners, developers, and contractors while they do not reap the full benefits of the standards.

For example,

1. A 7,200 SF building, with limited heating to be used for vehicle storage. This current energy code and building code would require a standing seam roof system and (R19/R11) insulation in the roof and (R25) insulation in the walls. When priced with a fasten down roof system and just R19 in the roof and R13 walls, the material and labor price goes down by \$5.97/SF. That equates to a cost of \$42,984. That is enough to keep this project from being built.
2. A 100,000SF warehouse project used for storage of materials with heat maintained at 60 degrees or less and no cooling. The current building code and energy code would require a standing seam roof system and (R19/R11) insulation in the roof (R25) and insulation in the walls. Maintaining the standing seam roof system but changing the insulation to 6" in roof and 4" in walls results in a \$311,247 deduct just for material. With labor, material, and equipment the cost savings approach \$5.00/SF or \$500,000.

The systems required to meet the current energy code are complicated and time consuming. These systems have other drawbacks such a liner system that cover up the purlins and girts affecting other trades such as plumbing, HVAC, electrical, and sprinkler. (The added cost to the electrical and mechanical trades are in addition to the cost shown in the examples above.) The trims on overhead doors and window on the new required systems are deep. These trims make the wall accessories look recessed and some would say less attractive. The current energy code makes some architectural features more difficult to design and build around. For example, just adding a masonry wainscot becomes a challenge.

Attached Files

- **HB1289.pdf**

<https://va.cdpassess.com/proposal/997/1260/files/download/577/>

FP107.12-21

VFC: 107.12

Proponents: DHCD Staff (sbco@dhcd.virginia.gov)

2018 Virginia Statewide Fire Prevention Code

Revise as follows:

107.12 State annual compliance inspection fees. Fees for compliance inspections performed by the *State Fire Marshal's* office shall be as follows:

1. Nightclubs.
 - 1.1. \$350 for *occupant load* of 100 or less.
 - 1.2. \$450 for *occupant load* of 101 to 200.
 - 1.3. \$500 for *occupant load* of 201 to 300.
 - 1.4. \$500 plus \$50 for each 100 occupants where *occupant loads* exceed 300.
2. Private college dormitories with or without assembly areas. If containing assembly areas, such assembly areas are not included in the computation of square footage.
 - 2.1. \$150 for 3,500 square feet (325 m²) or less.
 - 2.2. \$200 for greater than 3,500 square feet (325 m²) up to 7000 square feet (650 m²).
 - 2.3. \$250 for greater than 7,000 square feet (650 m²) up to 10,000 square feet (929 m²).
 - 2.4. \$250 plus \$50 for each additional 3,000 square feet (279 m²) where square footage exceeds 10,000 square feet (929 m²).
3. Assembly areas that are part of private college dormitories.
 - 3.1. \$50 for 10,000 square feet (929 m²) or less provided the assembly area is within or attached to a dormitory *building*.
 - 3.2. \$100 for greater than 10,000 square feet (929 m²) up to 25,000 square feet (2323 m²) provided the assembly area is within or attached to a dormitory *building*, such as gymnasiums, auditoriums or cafeterias.
 - 3.3. \$100 for up to 25,000 square feet (2323 m²) provided the assembly area is in a separate or separate *buildings* such as gymnasiums, auditoriums or cafeterias.
 - 3.4. \$150 for greater than 25,000 square feet (2323 m²) for assembly areas within or attached to a dormitory *building* or in a separate or separate *buildings* such as gymnasiums, auditoriums or cafeterias.
4. Hospitals.
 - 4.1. \$300 for 1 to 50 beds.
 - 4.2. \$400 for 51 to 100 beds.
 - 4.3. \$500 for 101 to 150 beds.
 - 4.4. \$600 for 151 to 200 beds.
 - 4.5. \$600 plus \$100 for each additional 100 beds where the number of beds exceeds 200.

5. ~~Facilities licensed by the Virginia Department of Social Services based on licensed capacity as follows:~~ State-Regulated Care Facilities:

5.1 Facilities licensed by the Virginia Department of Social Services based on licensed capacity as follows:

~~5-1.~~ 5.1.1 \$50 for 1 to 8.

~~5-2.~~ 5.1.2 \$75 for 9 to 20.

~~5-3.~~ 5.1.3 \$100 for 21 to 50.

~~5-4.~~ 5.1.4 \$200 for 51 to 100.

~~5-5.~~ 5.1.5 \$300 for 101 to 150.

~~5-6.~~ 5.1.6 \$400 for 151 to 200.

~~5-7.~~ 5.1.7 \$500 for 201 or more.

Exception: Annual compliance inspection fees for any *building* or groups of *buildings* on the same *site* may not exceed \$2500.

5.2 Family Day Homes licensed by the Department of Education based on licensed capacity as follows:

5.2.1 \$50 for 1 to 8.

5.2.2 \$75 for 9 to 20.

5.2.3 \$100 for 21 to 50.

5.2.4 \$200 for 51 to 100.

5.2.5 \$300 for 101 to 150.

5.2.6 \$400 for 151 to 200.

5.2.7 \$500 for 201 or more.

Exception: Annual compliance inspection fees for any *building* or groups of *buildings* on the same *site* may not exceed \$2500.

6. Registered complaints.

6.1. No charge for first visit (initial complaint), and if violations are found.

6.2. \$51 per hour for each *State Fire Marshal's* office staff for all subsequent visits.

7. *Bonfires* (small and large) on state-owned property.

7.1. For a small *bonfire* pile with a total fuel area more than 3 feet (914 mm) in diameter and more than 2 feet (610 mm) in height, but not more than 9 feet (2743 mm) in diameter and not more than 6 feet (1829 mm) in height, the permit fee is \$50. If an application for a *bonfire permit* is received by the *State Fire Marshal's* office less than 15 days prior to the planned event, the permit fee shall be \$100. If an application for a *bonfire permit* is received by the *State Fire Marshal's* office less than 7 days prior to the planned event, the permit fee shall be \$150.

7.2. For a large *bonfire* pile with a total fuel area more than 9 feet (2743 mm) in diameter and more than 6 feet (1829 mm) in height, the permit fee is \$150. If an application for a *bonfire permit* is received by the *State Fire Marshal's* office less than 15 days prior to the planned event, the permit fee shall be \$300. If an application for a *bonfire permit* is received by the *State Fire Marshal's* office less than 7 days prior to the planned event, the permit fee shall be \$450.

Reason Statement: Effective July 1, 2021, pursuant to SB578 and HB1012, the oversight for Family Day Homes has been transferred from the Department of Social Services to the Department of Education. The proposal intends to update the fee schedule to ensure fees can be assessed based on the appropriate licensing authority for these facilities.

SB578: <https://lis.virginia.gov/cgi-bin/legp604.exe?ses=201&typ=bil&val=sb578&ses=201&typ=bil&val=sb578>

HB1012: <https://lis.virginia.gov/cgi-bin/legp604.exe?ses=201&typ=bil&val=Hb1012&ses=201&typ=bil&val=Hb1012>

For more information, please see the attached document "A Joint Communication of Virginia Departments of Social Services and Education".

This is a companion proposal to B313.3-21.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
This is an editorial change with no effect on resiliency.



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change with no impact on cost.

Attached Files

- **A Joint Communication of Virginia Departments of Social Services and Education.pdf**
<https://va.cdpassess.com/proposal/1058/1354/files/download/574/>

IB20-21

VRGC: 13VAC5-91-20.

Proponents: DHCD Staff

2018 Industrialized Building Safety Regulations

2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-91-20. Application and compliance. A. In accordance with § 36-81 of the Code of Virginia, registered industrialized buildings shall be acceptable in all localities as meeting the requirements of the Industrialized Building Safety Law (Chapter 4 (§ 36-70 et seq.) of Title 36 of the Code of Virginia), which shall supersede the building codes and regulations of the counties, municipalities and state agencies. Local requirements affecting industrialized buildings, including zoning, utility connections, preparation of the site and maintenance of the unit shall remain in full force and effect. All building officials are authorized to and shall enforce the provisions of the Industrialized Building Safety Law (Chapter 4 (§ 36-70 et seq.) of Title 36 of the Code of Virginia) and this chapter.

B. In accordance with § 36-78 of the Code of Virginia, no person, firm or corporation shall offer for sale or rental, or sell or rent, any industrialized building subject to any provisions of this chapter unless it conforms with the applicable provisions of this chapter. Further, any industrialized building constructed before January 1, 1972, shall remain subject to the ordinances, laws or regulations in effect at the time such industrialized building was constructed. Additionally, as a requirement of this chapter, any industrialized building bearing the label of a compliance assurance agency shall remain subject to the provisions of this chapter that were effective when such building was constructed, regardless of whether the building has been relocated.

C. In accordance with § 36-99 of the Code of Virginia and in accordance with the USBC, the installation or erection of industrialized buildings and alterations, additions, or repairs to industrialized buildings are regulated by the USBC and not this chapter. The USBC provides for administrative requirements for permits, inspections, and certificates of occupancy for such work.

D. The use of off-site manufactured intermodal freight containers, moving containers, or storage containers as building modules or components of an industrialized building ~~must~~ may be approved by the administrator in accordance with 13VAC5-91-150. In reviewing the use of the intermodal freight containers as structural building components, the administrator ~~will~~ may accept evaluation reports from accredited third-party evaluation services.

E. Off-site manufactured intermodal freight containers, moving containers and storage containers placed on site temporarily or permanently for use as a storage container are not subject to this chapter.

Reason Statement: This change is editorial in nature and clarifies that these requirements are not mandatory.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change is merely administrative in nature.

IB60-21

VRGC: 13VAC5-91-60.

Proponents: DHCD Staff


2018 Industrialized Building Safety Regulations

2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-91-60. Notice of violation from administrator. In accordance with § 36-82 of the Code of Virginia, whenever the administrator shall find any violation of this chapter, he shall order the person responsible ~~therefor~~ to bring the building into compliance within a reasonable ~~time, to be fixed in the order.~~ time. In addition, as a requirement of this chapter, the administrator may request assistance from the building official for enforcement of this section. Any order issued by the administrator pursuant to this section shall contain a statement explaining the right of appeal of the order.

Reason Statement: This change is editorial in nature – the previous wording was unclear what was being asked for on the notice of violation. This change simplifies the text.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This change is editorial and has no impact on cost.

IB115-21

VRGC: 13VAC5-91-115.

Proponents: DHCD Staff

2018 Virginia Industrialized Building Safety Regulations

2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-91-115. Change of occupancy classification. When the occupancy classification of a registered industrialized building is ~~proposed to be~~ changed, the change of occupancy shall be in accordance with one of the following.

1. ~~a~~ A compliance assurance agency shall inspect the building, including any disassembly necessary to determine whether compliance may be achieved for a change of occupancy classification in accordance with this chapter. If factory plans are available, then disassembly is not required to the extent that the factory plans can be reasonably verified to reflect the actual construction. Once any necessary work is completed, the compliance assurance agency shall prepare a report documenting the method utilized for the change of occupancy and any alterations to the building to achieve compliance. When the report is complete, the compliance assurance agency shall (i) mark the building with a new compliance assurance agency label in accordance with 13VAC5-91-210, which replaces the existing label; (ii) place a new manufacturer's data plate on the building in accordance with 13VAC5-91-245, which replaces the existing manufacturer's data plate and reflects the new occupancy classification; and (iii) forward a copy of the report and new data plate to the SBCO.
2. A building official shall determine that a change of occupancy for an industrialized building meets the requirements of the USBC. The building official may require the submittal of plans approved by a registered design professional, or inspection by an approved third party. A change of occupancy of a registered industrialized building, in accordance with the USBC and approved by the building official, must be reported to SBCO and the registration seal and data plate removed prior to occupancy.

Reason Statement: This change seeks to make it clear that the building official may approve a change of occupancy on a registered industrialized building provided they follow one of the methods listed.



Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal will not affect costs of construction and may alleviate additional regulatory burdens on homeowners seeking to modify their existing structure.

IB120-21

VRGC: 13VAC5-91-120.

Proponents: DHCD Staff

2018 Industrialized Building Safety Regulations

2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-91-120. Unregistered industrialized buildings. The building official shall determine whether any unregistered industrialized building complies with this chapter and shall require any noncomplying unregistered building to be brought into compliance with this chapter. ~~The building official shall enforce all applicable requirements of this chapter including those relating to the sale, rental and disposition of noncomplying buildings. The building chapter in accordance with one of the following:~~

1. The building may be registered in accordance with 13VAC5-91-125

2. The building official may approve the unregistered building in accordance with the USBC. The building official may require submission of full plans and specifications for each building. Concealed parts of the building may be exposed to the extent necessary to permit inspection to determine compliance with the applicable requirements. The building official may also accept reports of inspections and tests from individuals or agencies deemed acceptable to the building official.

Reason Statement: The text was reworked to make it clearer that it is not a requirement to have unregistered industrialized buildings become registered and that building officials have some leeway when approving unregistered buildings in accordance with Code of Virginia §36-99.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal clarifies administrative procedures and will not affect cost.

IB140-21

VRGC: 13VAC5-91-140.

Proponents: DHCD Staff

2018 Industrialized Building Safety Regulations


2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-91-140. Report to the SBCO. If ~~the~~ a building which has active violations is moved from ~~the~~ a jurisdiction before the violations have been corrected, the building official shall make a prompt report of the circumstances to the SBCO. The ~~re-port~~ report shall include all of the following:

1. A list of the uncorrected violations.
2. All information contained on the label pertinent to the identification of the building, the manufacturer and the compliance assurance agency.
3. The number of the Virginia registration seal.
4. The new destination of the building, if known.
5. The party responsible for moving the building.

Reason Statement: This change indicates more clearly that the report to the SBCO is for moved buildings with active violations. The previous wording implied that it was for buildings with violations and this change makes it explicit.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is editorial in nature and does not affect cost.

IB160-21

VRGC: 13VAC5-91-160., 13VAC5-91-170.

Proponents: DHCD Staff

2018 Industrialized Building Safety Regulations

2018 Virginia Building and Fire Code Related Regulations

Revise as follows:

13VAC5-91-160. Use of model codes and standards.

A. Industrialized buildings entering the production assembly line after the effective date of the 2018 edition of this chapter shall comply with all applicable requirements of the codes and standards listed in subsection B of this section except that the following codes and standards may be used for industrialized buildings entering the assembly line during a one-year period after the effective date of the 2018 edition of this chapter:

1. ICC *International Building Code* – 2015 Edition
2. ICC *International Plumbing Code* – 2015 Edition
3. ICC *International Mechanical Code* – 2015 Edition
4. National Fire Protection Association Standard Number 70 (*National Electrical Code*) – 2014 Edition
5. ICC *International Fuel Gas Code* – 2015 Edition
6. ICC *International Energy Conservation Code* – 2015 Edition
7. ICC *International Residential Code* – 2015 Edition

B. The following documents are adopted and incorporated by reference to be an enforceable part of this chapter:

1. ICC *International Building Code* – 2018 Edition
2. ICC *International Plumbing Code* – 2018 Edition
3. ICC *International Mechanical Code* – 2018 Edition
4. *National Electrical Code* – 2017 Edition
5. ICC *International Fuel Gas Code* – 2018 Edition
6. ICC *International Energy Conservation Code* – 2018 Edition
7. ICC *International Residential Code* – 2018 Edition
8. ICC/MBI 1200-2021 Standard for Off-site Construction: Planning, Design, Fabrication and Assembly
9. ICC/MBI 1205-2021 Standard for Off-site construction: Inspection and Regulatory Compliance

Note: As the 2018 editions of the International Codes are incorporated by reference as the construction standards for use with these regulations, this chapter is also referred to as the 2018 edition of the *Virginia Industrialized Building Safety Regulations* or the 2018 edition of this chapter.

The codes and standards referenced above may be procured from:

International Code Council, Inc.
500 New Jersey Avenue, NW, 6th Floor
Washington, DC 20001-2070

13VAC5-91-170. Amendments to codes and standards.

A. All requirements of the referenced model codes and standards that relate to fees, permits, certificates of use and occupancy, approval of plans and specifications, and other procedural, administrative and enforcement matters that address the same subject matter and impose differing requirements are deleted and replaced by the procedural, administrative and enforcement provisions of this chapter.

B. The referenced codes and standards are amended as set forth in the USBC.

Reason Statement: To provide additional resource for local governing bodies and regulatory agencies for the safety of off-site construction.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The new ICC/MBI standards that are being incorporated contain requirements that are applicable to industrialized building designers, manufacturers and third party Compliance Assurance Agencies (CAAs). While the requirements in the standards are based on current industry standards and best practices, that are already being met by most in the industry, incorporation of the new standards may result in changes and additional costs for some manufacturers or CAAs. However, standardizing the requirements for the design and regulatory approval of industrialized buildings will ultimately have a positive impact not only in Virginia, but regionally and nationally, by reducing overall costs and increasing affordability.

M403.3.1.1-21

VMC: TABLE 403.3.1.1

Proponents: Richard Grace (rgrace@culpepercounty.gov), VPMIA

2018 Virginia Mechanical Code

Revise as follows:

TABLE 403.3.1.1 MINIMUM VENTILATION RATES

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY#/1000 FT ² _a	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT ^{2 a}	EXHAUST AIRFLOW RATE CFM/FT ^{2 a}
Correctional facilities				
Booking/waiting	50	7.5	0.06	—
Cells				
without plumbing fixtures	25	5	0.12	—
with plumbing fixtures ⁹	25	5	0.12	1.0
Day room	30	5	0.06	—
Dining halls (see "Food and beverage service")	—	—	—	—
Guard stations	15	5	0.06	—
Dry cleaners, laundries				
Coin-operated dry cleaner	20	15	—	—
Coin-operated laundries	20	7.5	0.12	—
Commercial dry cleaner	30	30	—	—
Commercial laundry	10	25	—	—
Storage, pick up	30	7.5	0.12	—
Education				
Art classroom ⁸	20	10	0.18	0.7
Auditoriums	150	5	0.06	—
Classrooms (ages 5-8)	25	10	0.12	—
Classrooms (age 9 plus)	35	10	0.12	—
Computer lab	25	10	0.12	—
Corridors (see "Public spaces")	—	—	—	—
Day care (through age 4)	25	10	0.18	—
Lecture classroom	65	7.5	0.06	—
Lecture hall (fixed seats)	150	7.5	0.06	—
Locker/dressing rooms ⁹	—	—	—	0.25
Media center	25	10	0.12	—
Multiuse assembly	100	7.5	0.06	—
Music/theater/dance	35	10	0.06	—
Science laboratories ⁹	25	10	0.18	1.0
Smoking lounges ^b	70	60	—	—
Sports locker rooms ⁹	—	—	—	0.5
Wood/metal shops ⁹	20	10	0.18	0.5
Food and beverage service				
Bars, cocktail lounges	100	7.5	0.18	—
Bars or cocktail lounges designated as an area where smoking is permitted ^b	100	30	—	—
Cafeteria, fast food	100	7.5	0.18	—
Cafeteria or fast food designated as an area where smoking is permitted ^b	100	20	—	—

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY#/1000 FT	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R CFM/FT	EXHAUST AIRFLOW RATE CFM/FT
Dining rooms	70	7.5	0.18	—
Dining rooms designated as an area where smoking is permitted ^b	70	20	—	—
Kitchens (cooking) ^b	20	7.5	0.12	0.7
Hotels, motels, resorts and dormitories				
Bathrooms/toilet—private ^b	—	—	—	25/50 ^f
Bedroom/living room	10	5	0.06	—
Conference/meeting	50	5	0.06	—
Dormitory sleeping areas	20	5	0.06	—
Gambling casinos	120	7.5	0.18	—
Lobbies/prefunction	30	7.5	0.06	—
Multipurpose assembly	120	5	0.06	—
Medical facilities				
Medical procedure rooms ⁱ	20	15	—	—
Patient rooms ⁱ	10	25	—	—
Physical therapy rooms ⁱ	20	15	—	—
Offices				
Conference rooms	50	5	0.06	—
Main entry lobbies	10	5	0.06	—
Office spaces	5	5	0.06	—
Reception areas	30	5	0.06	—
Telephone/data entry	60	5	0.06	—
Private dwellings, single and multiple				
Garages, common for multiple units ^b	—	—	—	0.75
Kitchens ^b	—	—	—	25/100 ^f
Living areas ^c	Based on number of bedrooms. First bedroom, 2; each additional bedroom, 1	0.35 ACH but not less than 15 cfm/person	—	—
Toilet rooms and bathrooms ^g	—	—	—	20/50 ^f
Public spaces				
Corridors	—	—	0.06	—
Courtrooms	70	5	0.06	—
Elevator car	—	—	—	1.0
Legislative chambers	50	5	0.06	—
Libraries	10	5	0.12	—
Lounges designated as an area where smoking is permitted ^b	100	30	—	—
Museums (children's)	40	7.5	0.12	—
Museums/galleries	40	7.5	0.06	—
Places of religious worship	120	5	0.06	—
Shower room (per shower head) ⁹	—	—	—	50/20 ^f

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY#/1000 FT	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R CFM/FT	EXHAUST AIRFLOW RATE CFM/FT
Smoking lounges ^b	70	60	—	—
Toilet rooms — public ^g	—	—	—	50/70 ^e
Retail stores, sales floors and showroom floors				
Dressing rooms	—	—	—	0.25
Mall common areas	40	7.5	0.06	—
Sales	15	7.5	0.12	—
Shipping and receiving	2	10	0.12	—
Smoking lounges ^b	70	60	—	—
Storage rooms	—	—	0.12	—
Warehouses (see "Storage")	—	10	0.06	—
Specialty shops				
Automotive motor-fuel dispensing stations ^b	—	—	—	1.5
Barber	25	7.5	0.06	0.5
Beauty salons ^b	25	20	0.12	0.6
Nail salons ^{b, h}	25	20	0.12	0.6
Embalming room ^b	—	—	—	2.0
Pet shops (animal areas) ^b	10	7.5	0.18	0.9
Supermarkets	8	7.5	0.06	—
Sports and amusement				
Bowling alleys (seating areas)	40	10	0.12	—
Disco/dance floors	100	20	0.06	—
Game arcades	20	7.5	0.18	—
Gym, stadium, arena (play area)	7	20	0.18	—
Health club/aerobics room	40	20	0.06	—
Health club/weight room	10	20	0.06	—
Ice arenas without combustion engines	—	—	0.30	0.5
Spectator areas	150	7.5	0.06	—
Swimming pools (pool and deck area)	—	—	0.48	—
Storage				
Repair garages, enclosed parking garages ^{b,d}	—	—	—	0.75
Refrigerated warehouses/freezers	—	10	—	—
Warehouses	—	10	0.06	—
Theaters				
Auditoriums (see "Education")	—	—	—	—
Lobbies	150	5	0.06	—
Stages, studios	70	10	0.06	—
Ticket booths	60	5	0.06	—
Transportation				

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY#/1000 FT	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R CFM/FT	EXHAUST AIRFLOW RATE CFM/FT
Platforms	100	7.5	0.06	—
Transportation waiting	100	7.5	0.06	—
Workrooms				
Bank vaults/safe deposit	5	5	0.06	—
Computer (without printing)	4	5	0.06	—
Copy, printing rooms	4	5	0.06	0.5
Darkrooms	—	—	—	1.0
Meat processing ^c	10	15	—	—
Pharmacy (prep. area)	10	5	0.18	—
Photo studios	10	5	0.12	—

For SI: 1 cubic foot per minute = 0.0004719 m³/s, 1 ton = 908 kg, 1 cubic foot per minute per square foot = 0.00508 m³/(s · m²), °C = [(°F) - 32]/1.8, 1 square foot = 0.0929 m².

- a. Based on net occupiable floor area.
- b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Item 3).
- c. Spaces unheated or maintained below 50 °F are not covered by these requirements unless the occupancy is continuous.
- d. Ventilation systems in enclosed parking garages shall comply with Section 404.
- e. Rates are per water closet or urinal. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.
- f. Rates are per room unless otherwise indicated. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.
- g. Mechanical exhaust is required and recirculation from such spaces is prohibited except that recirculation shall be permitted where the resulting supply airstream consists of not more than 10 percent air recirculated from these spaces. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Items 2 and 4).
- h. For nail salons, each manicure and pedicure station shall be provided with a source capture system capable of exhausting not less than 50 cfm per station. Exhaust inlets shall be located in accordance with Section 502.20. Where one or more required source capture systems operate continuously during occupancy, the exhaust rate from such systems shall be permitted to be applied to the exhaust flow rate required by Table 403.3.1.1 for the nail salon.
- i. For spaces that are ~~not located in an ambulatory care facility or clinic~~, outpatient facilities as defined in Chapter 2 of the VCC.

Reason Statement: This proposed change is to footnote "i". The current language assumes the VCC definitions of "ambulatory care facility" and "clinic, outpatient" are similar, and they are not. This error in the current footnote makes the three occupancy classifications associated with this footnote unusable. The intent of this change during the 2018 code development cycle was to provide ventilation rates for general doctor or dentist offices without having to go to ASHRAE 170 as directed by VMC Section 407, Ambulatory Care Facilities and Group I-2 Occupancies. This proposed change corrects the 2018 error and brings forward the original intent.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a clarity proposal to allow the previously proposed intent to actually work.

P1003.3.2-21

IPC: CHAPTER 10, SECTION 1003, 1003.3.2

Proponents: Brent Werlein (bwerlein@vbgov.com)

2021 International Plumbing Code


CHAPTER 10 TRAPS, INTERCEPTORS AND SEPARATORS

SECTION 1003 INTERCEPTORS AND SEPARATORS

Revise as follows:

1003.3.2 Food waste disposers restriction. ~~A food waste disposer shall not discharge to a grease interceptor.~~ Where food waste grinders are used, a solids interceptor shall separate the discharge before connecting to the grease interceptor. Solids interceptors and grease interceptors shall be sized and rated for the discharge of the food waste grinder. Emulsifiers, chemicals, enzymes and bacteria shall not discharge into the food waste grinder.

Reason Statement: The use of food waste grinders also become a dumping sink for all food wastes and the grinders break up the food into small particles that heavily contribute to Fats, Oils and Grease production. Grease interceptors are not designed to handle solids loading so a solids interceptor is needed before a grease interceptor. If food waste grinder drains are allowed to bypass a grease interceptor, then the grease is passed through to the sewer collection system.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 
This proposal will not have an impact on the resiliency of the system in regards natural disasters, sea level rise and other climate concerns

Cost Impact: The code change proposal will increase the cost of construction
Having to add a solids separator within the series will increase the costs when compared to being able to bypass a grease interceptor.

PM505.3-21

VMNC: 505.3, 505.3.1, 505.3.2

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2018 Virginia Maintenance Code

Revise as follows:

505.3 Inspection and testing of backflow prevention systems. ~~Inspection~~ Maintenance and testing shall comply with Sections 505.3.1 and 505.3.2.

505.3.1 Inspections Maintenance. ~~Inspections shall be made of all backflow assemblies and air gaps to determine whether they are operable. shall be maintained in an operable condition.~~

505.3.2 Testing. Reduced pressure principle backflow preventer assemblies, double check-valve assemblies, double-detector check valve assemblies, and pressure vacuum breaker assemblies shall be tested at ~~the time of installation, immediately after repairs or relocation and at least annually.~~ least annually. Records of testing shall be available for inspection by the code official. The testing procedure shall be performed in accordance with one of the following standards: ASSE 5010-1013-1, Sections 1 and 2; ASSE 5010-1015-1, Sections 1 and 2; ASSE 5010-1015-2; ASSE 5010-1015-3, Sections 1 and 2; ASSE 5010-1015-4, Sections 1 and 2; ASSE 5010-1020-1, Sections 1 and 2; ASSE 5010-1047-1, Sections 1, 2, 3 and 4; ASSE 5010-1048-1, Sections 1, 2, 3 and 4; ASSE 5010-1048-2; ASSE 5010-1048-3, Sections 1, 2, 3 and 4; ASSE 5010-1048-4, Sections 1, 2, 3 and 4; or CAN/CSA B64.10.

Reason Statement: This code change removes invalid construction provisions for installation and repairs, and construction related inspection provisions. VMC section 103.1 and 103.2 establish that the VMC is for maintenance only and that no provision shall require alteration be made to an existing structure or to equipment unless it is an unsafe structure or unfit for human occupancy as defined in ch.2. Construction is regulated by the VCC and VEBC. Inspection and testing for new installations are already addressed in IPC and VRC. The code change maintains the code provisions for maintenance and maintenance based annual testing. Also, the annual tests are done by certified backflow prevention device workers so the added text in 505.3.2 codifies that the records of the tests shall be maintained and available for inspection by the code official.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal is removing invalid provisions.

PM606.1-21

IPMC: 606.1


Proponents: Michael Redifer

2021 International Property Maintenance Code

Revise as follows:

606.1 General. Elevators, dumbwaiters and escalators shall be maintained in compliance with ASME A17.1. An annual periodic inspection is required of all elevators and escalators. A locality shall be permitted to require a 6-month periodic inspection. Periodic tests are required of all elevators and escalators at the intervals listed in ASME A17.1 Appendix N. The code official may provide for such inspection by an approved agency or through agreement with other local certified elevator inspectors. An approved agency includes any individual, partnership or corporation who has met the certification requirements established in the VCS. The most current certificate of inspection shall be on display at all times within the elevator or attached to the ~~escalator-escalator or dumbwaiter~~, be available for public inspection in the office of the building operator or be posted in a publicly conspicuous location approved by the code official. ~~The inspection and tests shall be performed at not less than the periodic intervals listed in ASME A17.1, Appendix N, except where otherwise specified by the authority having jurisdiction. Where not displayed within the elevator or attached to the escalator, there shall be a notice of where the certificate of inspection is available for public inspection.~~

Reason Statement: Recent DHCD review of the applicability of periodic testing (Category 1,3 and 5) requirements for elevators and escalators led to the determination that long-standing practice of requiring these tests was not enforceable since their reference was contained in the non-mandatory Appendix N of ASME A17.1. This proposal is an effort to correct the unintended consequence of deleting reference to Appendix N from the International Property Maintenance Code. These periodic tests are essential to maintaining operational safety of the equipment. The section is re-ordered so that inspection types follow the inspection requirement and display of the certificate of inspection follows inspection types. Since dumbwaiters have historically been omitted from the annual inspection requirement they are also deleted from testing and display of certificate of inspection while maintenance in compliance with ASME A17.1 remains.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency  Performing the required safety tests at various intervals will have no effect on the susceptibility to or recovery from flooding, hazards related to projected sea level rise or damage caused by other natural disasters.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The safety tests associated with this proposal are not performed until at least 12 months after completion of construction.

PM703.2-21

IPMC: [BF] 703.2, [BF] 703.3, [BF] 703.7, [BF] 703.8

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2021 International Property Maintenance Code

Delete without substitution:

~~[BF] 703.2 Unsafe conditions. Where any components are not maintained and do not function as intended or do not have the fire resistance required by the code under which the building was constructed or altered, such components or portions thereof shall be deemed unsafe conditions in accordance with Section 114.1.1 of the International Fire Code. Components or portions thereof determined to be unsafe shall be repaired or replaced to conform to that code under which the building was constructed or altered. Where the condition of components is such that any building, structure or portion thereof presents an imminent danger to the occupants of the building, structure or portion thereof, the fire code official shall act in accordance with Section 114.2 of the International Fire Code.~~

Revise as follows:

[BF] 703.3 Maintenance. The required fire-resistance rating of fire-resistance-rated construction, including walls, firestops, shaft enclosures, partitions, smoke barriers, floors, fire-resistive coatings and sprayed fire-resistant materials applied to structural members and joint systems, shall be maintained. Such elements shall be visually inspected annually by the owner and repaired, restored or replaced where damaged, altered, breached or penetrated. maintained as constructed in accordance with the applicable building code. Records of inspections and repairs shall be maintained. Where concealed, such elements shall not be required to be visually inspected by the owner unless the concealed space is accessible by the removal or movement of a panel, access door, ceiling tile or entry to the space. ~~Openings made therein for the passage of pipes, electrical conduit, wires, ducts, air transfer and any other reason shall be protected with approved methods capable of resisting the passage of smoke and fire. Openings through fire-resistance-rated assemblies shall be protected by self- or automatic-closing doors of approved construction meeting the fire protection requirements for the assembly.~~

Delete without substitution:

~~[BF] 703.7 Vertical shafts. Interior vertical shafts, including stairways, elevator hoistways and service and utility shafts, which connect two or more stories of a building shall be enclosed or protected as required in Chapter 11 of the International Fire Code. New floor openings in existing buildings shall comply with the International Building Code.~~

Revise as follows:

[BF] 703.8 Opening protective closers. Where openings are required to be protected, opening protectives shall be maintained self-closing or automatic-closing by smoke detection. ~~Existing fusible link-type automatic door-closing devices shall be replaced if the fusible link rating exceeds 135°F (57°C).~~

Reason Statement: Deletion of Section 703.2- This provision is currently invalid per VMC section 101.6 #1 and #2 because unsafe structures are addressed in VMC section 106, which is the same subject matter as VMC 703.2 and IFC Section 111.1.1. The section is proposed for deletion, so it does not cause confusion.

Revision of Section 703.3- This code change removes invalid construction provisions for alterations and repairs that are regulated by the VEBC. VMC section 103.1 and 103.2 establish that the VMC is for maintenance only and that no provision shall require alteration be made to an existing structure or to equipment unless it is an unsafe structure or unfit for human occupancy as defined in ch.2. Construction is regulated by the VCC and VEBC. The added language clarifies that fire rated construction must be maintained as constructed.

Deletion of Section 703.7- This code change removes invalid retrofit provisions. VMC section 103.1 and 103.2 establish that the VMC is for maintenance only and that no provision shall require alteration be made to an existing structure or to equipment unless it is an unsafe structure or unfit for human occupancy as defined in ch.2. Furthermore, IFC Chapter 11 is not adopted as part of the USBC or SFPC. Retrofit requirements are provided in VEBC chapter 11 and have historically only been adopted by the BHCD based on legislative direction.

Revision of Section 703.8- This code change removes invalid retrofit provisions. VMC section 103.1 and 103.2 establish that the VMC is for maintenance only and that no provision shall require alteration be made to an existing structure or to equipment unless it is an unsafe structure or unfit for human occupancy as defined in ch.2. Retrofit requirements are provided in VEBC chapter 11 and have historically only been adopted by the BHCD based on legislative direction.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal removes provisions that are currently invalid; therefore, there is no cost impact to the change.

PM704.1.1-21

VMNC: 704.1.1, 704.1.2, 704.1.3

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2018 Virginia Maintenance Code

Revise as follows:

704.1.1 Maintenance and alterations. Fire protection systems shall be *maintained* in accordance with the applicable building code and the Statewide Fire Prevention Code ~~original installation standards for that system. Alterations and repairs to fire protection systems shall be done in accordance with the applicable building code and the applicable standards.~~

Delete without substitution:

704.1.2 Required fire protection systems. Fire protection systems shall be repaired, operated, tested, and maintained in accordance with this code. A fire protection system for which a design option, exception, or reduction to the provisions of this code or the *applicable building code* has been granted shall be considered to be a required system.

704.1.3 Fire protection systems. Fire protection systems shall be *maintained* in accordance with the *Statewide Fire Prevention Code*.

Reason Statement: Sections 704.1.1 and 704.1.3- The “applicable building code” is the standard reference for maintenance standards in the VMC and SFPC. Additionally, providing a cross reference to the SFPC allows deletion of section 704.1.3. All alterations and repairs are required to comply with applicable building codes and it should not be restated in each or select sections of the VMC.

Section 704.1.2- This code change removes invalid construction provisions in the first sentence for repairs that are regulated by the VEBC. Operation of fire protection systems is addressed in the SFPC, not this code (the VMC) as the first sentence states. VMC section 103.1 and 103.2 establish that the VMC is for maintenance only and that no provision shall require alteration be made to an existing structure or to equipment unless it is an unsafe structure or unfit for human occupancy as defined in ch.2. VMC Section 704.1 already requires maintenance of all fire protection systems. Whether or not the system is considered required does not impact application of VMC 704.1 so the second sentence is redundant in that regard. VMC section 103.2.2 addresses maintenance of nonrequired fire protection systems.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change to the Virginia Maintenance Code does not affect the cost of construction.

PM704.2-21

IPMC: [F] 704.2, TABLE 704.2, [F] 704.2.1, [F] 704.2.2

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2021 International Property Maintenance Code

Delete without substitution:

~~**[F] 704.2 Standards.** Fire protection systems shall be inspected, tested and maintained in accordance with the referenced standards listed in Table 704.2 and as required in this section.~~

TABLE 704.2 FIRE PROTECTION SYSTEM MAINTENANCE STANDARDS

SYSTEM	STANDARD
Portable fire extinguishers	NFPA 10
Carbon dioxide fire extinguishing system	NFPA 12
Halon-1301 fire extinguishing systems	NFPA 12A
Dry-chemical extinguishing systems	NFPA 17
Wet-chemical extinguishing systems	NFPA 17A
Water-based fire protection systems	NFPA 25
Fire alarm systems	NFPA 72
Smoke and heat vents	NFPA 204
Water-mist systems	NFPA 750
Clean-agent extinguishing systems	NFPA 2001

Revise as follows:

[F] 704.2.1 704.2-1 Records. ~~Records~~


~~Inspection, testing and maintenance records shall be maintained in accordance with the Statewide Fire Prevention Code of all system inspections, tests and maintenance required by the referenced standards.~~

Delete without substitution:

~~**[F] 704.2.2 Records information.** Initial records shall include the: name of the installation contractor; type of components installed; manufacturer of the components; location and number of components installed per floor; and manufacturers' operation and maintenance instruction manuals. Such records shall be maintained for the life of the installation.~~

Reason Statement: 704.2- Inspection, testing and maintenance of fire protection systems is addressed in detail in the SFPC and this table is in SFPC Section 901.6 (SFPC table 901.6.1). The general provision already in 704 to maintain in accordance with the SFPC and USBC is enough for the VMC. At what point will a maintenance code inspector also need to be certified as a fire prevention inspector? At some point we have crossed the line between code lanes and this provision crosses that line.

704.2.1 and 704.2.2- 704.2.1 should simply reference the SFPC and 704.2.2 is not needed since it is copied from SFPC section 901.6.3.1.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This change does not impact construction costs.

PM704.3-21

IPMC: [F] 704.3; VMNC: 704.3.1

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2021 International Property Maintenance Code

Revise as follows:

~~[F] 704.3 Systems out of service. Where a required fire protection system is out of service, it shall be done in accordance with the Statewide Fire Prevention Code and the fire department and the fire code official shall be notified immediately and, where required by the fire code official, either the building shall be evacuated or an approved fire watch shall be provided for all occupants left unprotected by the shutdown until the fire protection system has been returned to service. Where utilized, fire watches shall be provided with not less than one approved means for notification of the fire department and shall not have duties beyond performing constant patrols of the protected premises and keeping watch for fires. Actions shall be taken in accordance with Section 901 of the International Fire Code to bring the systems back in service.~~

~~**Exception:** Facilities with an approved notification and impairment management program. The notification and impairment program for water-based fire protection systems shall comply with NFPA 25.~~

2018 Virginia Maintenance Code

Delete without substitution:

~~704.3.1 Preplanned impairment programs. Preplanned impairments shall be authorized by the impairment coordinator. Before authorization is given, a designated individual shall be responsible for verifying that all of the following procedures have been implemented:~~

- ~~1. The extent and expected duration of the impairment have been determined.~~
- ~~2. The areas or buildings involved have been inspected, and the increased risks determined.~~
- ~~3. Recommendations have been submitted to management or the building owner or manager.~~
- ~~4. The fire department has been notified.~~
- ~~5. The insurance carrier, the alarm company, the building owner or manager, and other authorities having jurisdiction have been notified.~~
- ~~6. The supervisors in the areas to be affected have been notified.~~
- ~~7. A tag impairment system has been implemented.~~
- ~~8. Necessary tools and materials have been assembled on the impairment site.~~

Reason Statement: VMC 704.3 is proposed to be revised to refer to the SFPC rather than reproduce the section here in the VMC. All of the code provisions and subsequent sub-sections proposed for deletion are in SFPC 901.7. All of these code provisions are within the authority of the fire official and belong in the SFPC.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction. This code change will not impact construction cost.

PM704.4-21

VMNC: 704.4; IPMC: [F] 704.4.1; VMNC: 704.4.2; IPMC: [F] 704.4.3

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2018 Virginia Maintenance Code

Delete without substitution:

~~704.4 Removal of or tampering with equipment.~~ It shall be unlawful for any person to remove, tamper with, or otherwise disturb any fire hydrant, fire detection and alarm system, fire suppression system, or other fire appliance required by this code or the *applicable building code* except for the purpose of extinguishing fire, for training purposes, for recharging or making necessary repairs, or where *approved* by the fire code official.

2021 International Property Maintenance Code

Delete without substitution:

~~[F] 704.4.1 Removal of or tampering with appurtenances.~~ Locks, gates, doors, barricades, chains, enclosures, signs, tags and seals that have been installed by or at the direction of the *fire code official* shall not be removed, unlocked, destroyed or tampered with in any manner.

2018 Virginia Maintenance Code

Delete without substitution:

~~704.4.2 Removal of existing occupant use hose lines.~~ The fire code official is authorized to permit the removal of existing occupant use hose lines where all of the following conditions exist:


- ~~1. Installation is not required by this code or the *applicable building code*.~~
- ~~2. The hose line would not be utilized by trained personnel or the fire department.~~
- ~~3. The remaining outlets are compatible with local fire department fittings.~~

2021 International Property Maintenance Code

Delete without substitution:

~~[F] 704.4.3 Termination of monitoring service.~~ For fire alarm systems required to be monitored by the *International Fire Code*, notice shall be made to the *fire code official* whenever alarm monitoring services are terminated. Notice shall be made in writing by the provider of the monitoring service being terminated.

Reason Statement: The provisions of VMC section 704.4 and the sub-sections are copied directly from SFPC sections 901.8 and 901.9. These are clearly SFPC provisions that are enforced by the fire code official, as referenced in each VMC version of the sections, and should not be copied and pasted into the VMC. These provisions should be enforced by the fire code official, not the maintenance code official.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This code change will not impact construction costs.

PM704.5-21

VMNC: [F] 704.5; IPMC: [F] 704.5.1, [F] 704.5.2

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2018 Virginia Maintenance Code

Delete without substitution:

~~[F] 704.5 Fire department connection. (Section deleted.)~~

2021 International Property Maintenance Code

Revise as follows:

~~[F] 704.5.1 704.5.1 Fire department connection access. Ready access to fire department connections shall be maintained at all times and without obstruction by fences, bushes, trees, walls or any other fixed or movable object. Access to fire department connections shall be approved by the fire chief chief.~~

Exception: Fences, where provided with an access gate equipped with a sign complying with the legend requirements of Section 912.5 of the International Fire Code and a means of emergency operation. The gate and the means of emergency operation shall be approved by the fire chief and maintained operational at all times.

~~[F] 704.5.2 704.5.1 Clear space around connections. A working space of not less than 36 inches (914 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height shall be provided and maintained in front of and to the sides of wall-mounted fire department connections and around the circumference of free-standing fire department connections.~~

Reason Statement: SFPC section 912 provides these code provisions for the fire code official to use for SFPC enforcement. The provision for the VMC should be limited to maintenance of the clearances and access.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact: The code change proposal will not increase or decrease the cost of construction. This code change will not impact construction cost.

PM705.1-21

IPMC: [F] 705.1, [F] 705.2, NFPA Chapter 08

Proponents: Ronald Clements (clementsro@chesterfield.gov)

2021 International Property Maintenance Code

Delete without substitution:

~~[F] 705.1 General. Carbon monoxide alarms shall be installed in dwellings in accordance with Section 1103.9 of the International Fire Code, except that alarms in dwellings covered by the International Residential Code shall be installed in accordance with Section R315 of that code.~~

Revise as follows:

[F] 705.2 Carbon monoxide alarms and detectors. Carbon monoxide alarms and carbon monoxide detection systems shall be maintained in accordance with NFPA 720. Carbon monoxide alarms and carbon monoxide detectors that become inoperable or begin producing end-of-life signals shall be replaced. ~~720.~~

Delete without substitution:


NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

720—15

~~Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment~~

Reason Statement: This code change removes invalid retrofit provisions. VMC section 103.1 and 103.2 establish that the VMC is for maintenance only and that no provision shall require alteration be made to an existing structure or to equipment unless it is an unsafe structure or unfit for human occupancy as defined in ch.2. Furthermore, IFC Chapter 11 is not adopted as part of the USBC or SFPC. Retrofit requirements are provided in VEBC chapter 11 and have historically only been adopted by the BHCD based on legislative direction. Change of the referenced standard from NFPA 720 to 72 is due to the fact that CO provisions were moved to NFPA 72-19.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This removes a currently invalid provision so there is no cost impact.

RB324.6.1-21

VRC: R324.6.1

Proponents: Jason Laws (lawsj@chesterfield.gov)

2018 Virginia Residential Code

Revise as follows:

R324.6.1 Pathways. ~~Not fewer than two pathways, on separate roof planes from lowest roof edge to ridge and not less than 36 inches (914 mm) wide. A minimum 36" wide pathway shall be provided on all buildings. Not fewer than one pathway shall be provided on the street or driveway side of the roof. For each roof plane with a photovoltaic array, a pathway not less than 36 inches wide (914 mm) shall be provided~~ roof planes with photovoltaic arrays. Each pathway shall provide access from the lowest roof edge to ridge on the same roof plane as the photovoltaic array, on an adjacent roof plane, or straddling the same and adjacent roof planes. Pathways shall be over areas capable of supporting fire fighters accessing the roof. Pathways shall be located in areas with minimal the ridge and be free of obstructions such as vent pipes, conduit, or mechanical equipment.

Reason Statement: The purpose of this proposal is for clarification. The current code provision includes excessive, unneeded language which makes this section confusing and hard to follow.

The language requiring a pathway "on the street or driveway side of the roof" is not needed. If you have a pathway on any plane a photovoltaic panel is installed, you will always meet this requirement. If panels are only on the rear of the house, the entire front roof plane is clear and creates a pathway by default. If you have panels on the front of the house, then a pathway is needed and would still meet this requirement.

The language requiring a pathway "on an adjacent roof plane, or straddling the same and adjacent roof planes." only creates confusion and could result in "pathways" that are not functional / usable.

The language requiring "Pathways shall be over areas capable of supporting fire fighters accessing the roof." is not needed. The minimum design loads in R301.6 already cover this.

The intent of the code would remain the same but this proposal makes it much easier to understand, making it easier to design and enforce

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposal does not increase or decrease the cost of construction. This proposal keeps the intent of the code the same, simply makes it easier for everyone to understand and apply.

RB324-21

IRC: R324.6.1

Proponents: Alan Larsen (alarsen120@aol.com)

2021 International Residential Code

Revise as follows:

R324.6.1 Pathways. ~~Not fewer than two pathways. One pathway of 18 inches width on separate roof planes~~ from lowest roof edge to ridge ~~and not less than 36 inches (914 mm) wide, shall be provided on all buildings. Not fewer than one~~ One pathway shall be provided on the street or driveway side of the roof. ~~For~~ For each roof plane with a photovoltaic array, a pathway ~~not less than 36 inches wide (914 mm) of 18 inches shall be provided from the lowest roof edge to ridge on the same roof plane as the photovoltaic array, on an adjacent roof plane, or straddling the same and adjacent roof planes. Pathways plane if the adjacent roof plane has a photovoltaic array. If the adjacent roof plane does not have a photovoltaic array, then no pathway is required.~~ Pathways shall be over areas capable of supporting fire fighters accessing the roof. Pathways shall be located in areas with minimal obstructions such as vent pipes, conduit, or mechanical equipment.

Reason Statement: We submit these written comments for the record in the 2021 Code Development Cycle, pursuant to the Notices of Intended Regulatory Action (NOIRA) approved by the Board of Housing and Community Development (BHCD) on October 25, 2021 and published in the Virginia Register of Regulations on November 22, 2021.

We represent solar installation companies and organizations that provide and install rooftop solar facilities for residential and commercial customers throughout the Commonwealth of Virginia. We are addressing IRC Code provision R324.6.1 that pertains to access (pathways) to rooftops for fire fighting purposes, and requirements that go beyond what is needed for safety to become impediments to solar installations.

Setbacks are meant for safety and accessibility for firemen to do their work. The code is written in terms that refer to the distance from the edge of the roofline to the side of the nearest solar panel. But across-the-board requirements that are stated merely as inches-of-width, without regard to where such set-backs would be placed and why, do not create safer conditions. Of course it's good practice to have a setback on roofs where firemen could have to operate in case of emergency, but what about the roofs where fire fighters would never walk?

Virginia has adopted a statutory mandate to encourage installation of rooftop solar and eliminate impediments to doing that. On the other hand, it has fire and safety requirements. The Code must balance those two policy goals and legal mandates. A provision that creates greater impediments to solar would undercut the solar imperative for no safety gain.

In 2014, our industry encountered a fire code setback issue in Arlington. We contacted the state, and the Commonwealth's Department of Housing and Community Development addressed the issue as follows:

"Chapter 23 of the IRC [International Residential Code] regulates the installation of residential photo voltaic roof systems and requires them to be installed in accordance with NFPA 70 (NEC) and the manufacturer's installation instructions. Specifically the IRC does nor reference the Fire Code, therefor photo voltaic requirements set forth in the Fire Code are not applicable to one and two family dwellings that fall within the scope of the IRC."

Aside from the issue of applicability of R324.6.1 to residential rooftop installations, this statement from the Commonwealth indicates the balance that the state brings to the issue of impediments to solar installations versus safety measures. And this was before the adoption by the 2020 session of the General Assembly of additional mandates to further solar installations, including the Virginia Clean Economy Act which made promotion and installation of solar facilities a state-wide priority and mandate.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency



Cost Impact:

None.

REC-R403.3.3-21

VRC: N1103.3.3, N1103.3.4 (R403.3.4), N1103.3.5

Proponents: Eric Lacey (eric@reca-codes.com)

2018 Virginia Residential Code

Revise as follows:

N1103.3.3 (R40333) Duct testing (Mandatory). Ducts shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1-inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1-inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exception: A duct air leakage test shall not be required ~~where the ducts and air handlers are located entirely within the building thermal envelope~~ for ducts serving heating, cooling or ventilation systems that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. The licensed mechanical contractor installing the mechanical system shall be permitted to perform the duct testing. The contractor shall have been trained on the *equipment* used to perform the test.

N1103.3.4 (R403.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

~~4-3-4~~

1.

4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test.
3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

2.

4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

3. Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall

N1103.3.5 (R40335) Building cavities (Mandatory). ~~(Section deleted)~~

Building framing cavities shall not be used as ducts or plenums.

Reason Statement: This proposal updates the code provisions related to duct testing to be consistent with the 2021 IECC. A few of the changes proposed (such as the requirement that building cavities not be used as ducts or plenums) have been in the IECC for several editions; others (such as the addition of a duct test for ducts inside conditioned space) were added in the 2021 IECC update. It incorporates the changes brought about by proposals RE112-19, RE114-19, and RE118-19.

This proposal establishes a maximum level of allowable duct leakage -- regardless of the location of the ducts. From the proponent's original reason statement in proposal RE115:

"The purpose of this code change proposal is to help ensure long-term energy savings, occupant comfort and promote good building quality by establishing a maximum level of duct leakage permitted as a trade-off backstop for duct tightness. We propose a backstop that would still permit substantial flexibility -- double the allowable leakage rate as the prescriptive requirement -- but that would establish a "worst case scenario" for all tested homes in all compliance paths. There is currently no upper limit on duct leakage in the IECC. In the 2012 IECC, all ducts (except those in conditioned space) were required on a mandatory basis to meet the prescriptive levels. The mandatory nature of the requirement was removed in 2015, allowing duct tightness to be fully traded off for other efficiency measures. We believe some trade-off is acceptable, but that a minimum level of duct tightness is necessary to ensure some reasonable level of duct performance occurs in the home. When ducts are excessively leaky, there is

no assurance that conditioned air is provided where it is needed for adequate comfort. The failure to properly distribute conditioned air is likely to result in excess energy usage when the occupants adjust the thermostat to counter an inadequate distribution of conditioned air. Many of the intended benefits of high-performance homes are negated if occupants are uncomfortable and adjust the thermostat in response."

We note that this proposal (RE115) was recommended for approval by the IECC-Residential Committee and no public comments were filed, meaning that no stakeholders opposed its incorporation into the 2021 IECC. This proposal also removes the exception from duct leakage testing for systems located entirely within the building envelope. This proposal (RE112) was recommended for approval by the IECC-Residential Committee, and then was approved by over 87% of the Governmental Member Voting Representatives at ICC for inclusion in the 2021 IECC. From the proponent's original reason statement in proposal RE112: The purpose of this code change proposal is to help ensure occupant comfort, proper heating and cooling system performance, and resulting long-term energy savings by requiring a duct leakage test for all new homes, including homes with all ducts inside conditioned space. This action will also help reduce the likelihood of builder callbacks for poorly-functioning, uncomfortable HVAC systems. The IECC currently exempts homes from duct testing requirements where the air handler and all ducts are located inside conditioned space. Although moving all ducts inside conditioned space may have a positive impact on energy efficiency overall, this practice alone cannot guarantee that the ducts will be tight enough to deliver conditioned air to all occupied areas of the home. Uncomfortable occupants commonly adjust thermostat settings to counteract the effect of poor delivery of conditioned air, leading to huge losses in energy efficiency. And these homes are at far greater risk for builder callback. This proposal will improve building quality and keep occupants more comfortable by requiring a duct test for all new homes, although the allowable leakage rate will be set at twice the prescriptive rate when all ducts are located inside conditioned space. Duct leakage rates can be extremely high when ducts are not tested. We do not believe that builders intentionally cut corners in duct sealing when they know that the system will not be tested. However, without an objective test as a means of quality assurance, even careful builders may not be aware of missed connections or poor sealing. In a recent DOE field study of residential homes in Kentucky, homes received duct leakage tests even where all supply and return ducts were located inside conditioned space. The results were striking – **of the 24 homes tested (that would have qualified for the test exemption under the IECC), all 24 homes had higher leakage rates than the 2018 IECC requirement. Tested duct leakage for these homes averaged 18.5 cfm/sq.ft., with individual homes ranging from 6.26 cfm/sq.ft. to as high as 40.36 cfm/sq.ft.** See <https://www.energycodes.gov/compliance/energy-code-field-studies>. We note that 40 other homes in the same study were required to be tested (because at least some ducts were located outside conditioned space), and these homes achieved leakage rates of 9.7 cfm/sq.ft., on average – roughly half the leakage rate of homes that qualified for the exemption. Obviously, this is a small sample size, but the Field Studies found similar results in Pennsylvania, where "exempt" homes (with all ducts inside conditioned space) averaged almost 31 cfm/sq.ft. leakage, while homes required to be tested averaged almost 18 cfm/sq.ft. leakage. Although the results vary across the states sampled, these results point to a shortcoming in the IECC's "complete exemption" approach to homes with all ducts inside conditioned space.

The concept of requiring a test for all new homes is not new. DOE's Building America Program recommends that "[e]ven in conditioned space, ducts should be insulated to reduce the risk of condensation and mold. They should be tightly sealed and tested for leakage." See https://www.energy.gov/sites/prod/files/2014/01/f6/1_1g_ba_innov_ductsconditionedspace_011713.pdf. Likewise, the International Association of Certified Home Inspectors recommends that ducts be located entirely within conditioned space and tested to ensure air tightness. Air leakage rates at air handlers, even when all ducts are located in conditioned space, can lead to significant reduction in comfort, leading homeowners to adjust the thermostat and significantly increase energy use. See <https://www.nachi.org/inspecting-hvac-cabinet-seams-air-leakage-sealing.htm>.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency 

Cost Impact: The code change proposal will increase the cost of construction

For homes that would not have been required to test ducts (because they are located inside conditioned space), this proposal will result in a construction cost increase of about \$200 for a duct test. However, the proposal substantially reduces homeowner risk, because the test will objectively verify that the heating and cooling systems are operating as intended, and will provide an opportunity for the builder to correct any mistakes. The test will also reduce the likelihood of a builder callback.

2018 VUSBC AND I-CODE PROVISIONS APPLICABLE TO CONSTRUCTION IN FLOOD HAZARD AREAS

Red underlined and ~~strikethrough~~ are proposed changes to provide resilience.

USBC - Virginia Construction Code (VCC and IBC)

102.2.2 Flood and coastal wind hazard resilience areas. Notwithstanding the foregoing restrictions on scope, localities within Coastal Virginia may, but are not required to, establish flood and coastal wind hazard resilience areas. Within flood and coastal wind hazard resilience areas, all development in these coastal areas of the Commonwealth shall be designed and constructed to resist all forces placed on buildings related to tropical cyclones, Nor'easters, high-tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea-level rise. This shall require that for any new construction within Resilience Areas, the resulting structure shall be stronger, more resilient and less subject to risks from flooding and high winds than may otherwise be provided in this Code. The following shall be included in flood and coastal wind resilience areas:

1. A sea-level rise factor shall be incorporated into plans for all new construction subject to this Code. At a minimum, the factor shall consider 50 years of projected sea-level rise using a locally adopted method and projection. In the absence of a locally adopted method, the design of permanent structures shall include three feet (90cm) of sea level rise plus three feet (90cm) of freeboard to the lowest habitable floor elevation.
2. The mandated use of FEMA Technical Bulletin best practices for coastal construction shall be required within resilience areas.
3. A continuous load path from roof to foundation shall be provided in each new building subject to this Code and shall be certified by an RDP as sufficient to manage the lateral, twisting or racking, uplift and compression forces reasonably expected to act on the structure over the expected lifespan of the structure or 50 years, whichever is the greater timeframe.
4. The mandated use of recognized performance- and resilience-based codes shall be permitted by local adoption within resilience areas, provided that the relevant portions of such codes are used in their entirety.
5. Restrictions on the construction and use of basements shall be a permissible local adoption.

103.4 Use of certain provisions of referenced codes. The following provisions of the IBC and of other indicated codes or standards are to be considered valid provisions of this code. Where any such provisions have been modified by the state amendments to the IBC, then the modified provisions apply.

1. Special inspection requirements in Chapters 2 - 35.
2. Testing requirements and requirements for the submittal of *construction* documents in any of the ICC codes referenced in Chapter 35 and in the IRC.

3. Section R301.2 of the IRC authorizing localities to determine climatic and geographic design criteria.
4. Flood load or flood-resistant *construction* requirements in the IBC or the IRC, including, but not limited to, any such provisions pertaining to flood elevation certificates that are located in Chapter 1 of those codes. Any required flood elevation certificate pursuant to such provisions shall be prepared by a land surveyor or engineer licensed in Virginia ~~or a registered design professional (RDP)~~.
5. Section R101.2 of the IRC.
6. Section N1102.1 of the IRC and Sections C402.1.1 and R402.1 of the IECC.

105.1.1 Qualifications of building official. The building official shall have at least five years of building experience as a licensed professional engineer or architect, building, fire or trade inspector, contractor, housing inspector or superintendent of building, fire or trade *construction* or at least five years of building experience after obtaining a degree in architecture or engineering, with at least three years in responsible charge of work. Any combination of education and experience that would confer equivalent knowledge and ability shall be deemed to satisfy this requirement. The building official shall have general knowledge of sound engineering practice in respect to the design and *construction* of structures, the basic principles of fire prevention, the accepted requirements for means of egress and the installation of elevators and other service *equipment* necessary for the health, safety and general welfare of the occupants and the public. In localities in Coastal Virginia, the building official shall have general knowledge of the principles and requirements of floodplain and high-velocity wind construction. The *local governing body* may establish additional qualification requirements.

105.2.1 Qualifications of technical assistants. A technical assistant shall have at least three years of experience and general knowledge in at least one of the following areas: building *construction*; building *construction* conceptual and administrative processes; building, fire or housing inspections; plumbing, electrical or mechanical trades; or fire protection, elevator or property maintenance work. In localities in Coastal Virginia, technical assistants shall have general knowledge of the principles and requirements of floodplain and high-velocity wind construction. Any combination of education and experience that would confer equivalent knowledge and ability, including high school technical training programs or college engineering, architecture, or construction degree programs, shall be deemed to satisfy this requirement. The *locality* may establish additional qualification requirements.

105.2.2 Certification of technical assistants. A technical assistant shall be certified in the appropriate subject area within 18 months after becoming a technical assistant. When required by local policy to have two or more certifications, a technical assistant shall obtain the additional certifications within three years from the date of such requirement. In localities in Coastal Virginia, at least one technical assistant shall be a Certified Floodplain Manager (CFM) or hold an equivalent certification in floodplain construction requirements.

108.2 Exemptions from application for permit.

* * *

Exceptions:

1. Application for a permit may be required by the building official for the installation of replacement siding, roofing and windows in buildings within a historic district designated by a locality pursuant to Section 15.2-2306 of the Code of Virginia.
2. Application for a permit ~~may~~shall be required by the building official for ~~any~~ items otherwise exempted in this section which are located within a special flood hazard area.

113.3 Minimum inspections. The following minimum inspections shall be conducted by the building official when applicable to the construction or permit:

1. Inspection of footing excavations and reinforcement material for concrete footings prior to the placement of concrete.
2. Inspection of foundation systems during phases of construction necessary to assure compliance with this code.
3. Inspection of preparatory work prior to the placement of concrete.
4. Inspection of the elevation of the lowest floor in accordance with Section 110.3.3 prior to further vertical construction located in any flood hazard area or special flood hazard area.
5. Inspection of structural members and fasteners prior to concealment.
6. Inspection of electrical, mechanical and plumbing materials, equipment and systems prior to concealment.
7. Inspection of energy conservation material prior to concealment.
8. Inspection of the elevation of the lowest floor in accordance with Section 110.3.10.1 prior to final inspection located in any flood hazard area or special flood hazard area.
9. Final inspection.

113.3.2 Lowest floor elevation. In flood hazard areas, upon placement of the lowest floor, including the basement, and prior to further vertical construction, the elevation certification required in Section 1612.5 shall be submitted to the building official.

113.3.3 Flood hazard documentation. If located in a flood hazard area, documentation of the elevation of the lowest floor as required in Section 1612.5 shall be submitted to the building official prior to the final inspection.

Add the following definitions to Section 202 of the IBC to read:

FLOOD AND COASTAL WIND HAZARD RESILIENCE AREAS. A designation in the local government comprehensive plan of coastal communities in the Commonwealth which identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, tropical cyclones, Nor'easters, flash floods, stormwater runoff and that are vulnerable to the related impacts of rising sea level for the purpose of prioritizing funding for infrastructure needs and adaptation planning, including establishment of higher standards for building construction, reconstruction, alteration and repair within the Resilience Area. Examples of Flood and Coastal

Wind Resilience Areas may include, but are not limited to designated floodplains and special flood hazard areas, Chesapeake Bay Preservation Areas, designated evacuation zones and routes, areas determined by modelling to be at risk from recurrent flooding resulting from sea level rise within fifty years, areas within 1000 feet of the coastline of the ocean, bay or estuarian reach of a tidal river and other similar areas designated within the local comprehensive plan. Any locality in Coastal Virginia may adopt *Flood and Coastal Wind Resilience Areas* but shall not be obligated to do so.

[IBC] FUNCTIONALLY DEPENDENT FACILITY. A facility that cannot be used for its intended purpose unless it is located or carried out in close proximity to water, such as a docking or port facility necessary for the loading or unloading of cargo or passengers, shipbuilding or ship repair. The term does not include long-term storage, manufacture, sales or service facilities.

Change the following definitions in Section 202 of the IBC to read:

[BS] BASE FLOOD ELEVATION. The elevation of the base flood, including wave height, relative to the National Geodetic Vertical Datum (NGVD), North American Vertical Datum (NAVD) or other datum specified on the Flood Insurance Rate Map (FIRM), and as shown in the *Flood Insurance Study*.

[BS] COASTAL A ZONE. Area within a special flood hazard area, landward of a V zone or landward of an open coast without mapped *Coastal High Hazard Areas*. In a *Coastal A Zone*, the principal source of flooding must be astronomical tides, storm surges, seiches or tsunamis, not riverine flooding. During the base flood conditions, the potential for breaking wave height shall be greater than or equal to 1-1/2 feet (457 mm), and not greater than three feet (90 cm). The inland limit of the *Coastal A Zone* is (a) the Limit of Moderate Wave Action if delineated on a FIRM, or (b) designated by the authority having jurisdiction.

[BS] COASTAL HIGH HAZARD AREA. Area within the special flood hazard area extending from offshore to the inland limit of a ~~primary dune~~ Coastal Primary Sand Dune, as defined by state code (Code of Virginia Title 28.2), along an open coast and any other area that is subject to high-velocity wave action from storms or seismic sources, and shown in either the *Flood Insurance Study*, or on the *Flood Insurance Rate Map (FIRM)* or other flood hazard map as velocity Zone V, VO, VE or V1-30 (areas subject to wave heights of 3 feet (90 cm) or more).

[BS] DESIGN BASE FLOOD. The flood associated with the greater of the following two areas:

1. Area with a flood plain subject to a 1-percent or greater chance of flooding in any year (also known as the 100-year floodplain).
2. Area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated, including areas shown in either the *Flood Insurance Study* or on the *Flood Insurance Rate Map (FIRM)*.

[BS] DESIGN FLOOD ELEVATION. The base flood elevation of the "~~design base~~ flood," including wave height, plus three feet of freeboard, relative to the datum specified on the community's

legally designated flood hazard map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the building's perimeter plus the depth number (in feet) specified on the flood hazard map, plus 3 feet (90 cm) of freeboard. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (~~610 mm~~ 60 cm).

[A] EXISTING BUILDING. A building erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued. For application of provisions in flood hazard areas, an existing building is any building for which a complete building permit application was submitted, diligently pursued before the effective date of the community's first flood plain management code, ordinance, or standard, and provided that all work was carried out to completion without expiration of the legally issued building permit.

[BS] EXISTING STRUCTURE. A building erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued. For application of provisions in flood hazard areas, an existing structure is any structure for which a complete building permit application was submitted, diligently pursued before the effective date of the community's first flood plain management code, ordinance, or standard, and provided that all work was carried out to completion without expiration of the legally issued building permit.

[BS] [FLOOD or FLOODING].

1. A general and temporary condition of partial or complete inundation of normally dry land from either of the following:
 - 1.1 The overflow of inland or tidal waters.
 - 1.2 The unusual and rapid accumulation or runoff of surface waters from any source.
2. The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in subsection (1.1) of this definition.
3. Mudflows which are proximately caused by flooding as defined in subsection (1.2) of this definition and are akin to a river of liquid and flowing mud on the surface of normally dry land areas, as when earth is carried by a current of water and disposed along the path of the current.

FLOOD, ~~DESIGN BASE~~. See "Design Base flood"

[BS] FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of flooding in any year (also known as the 100-year floodplain).

2. The area designated as a *flood hazard area* on a community's flood hazard map, or otherwise legally designated, including areas shown in either the Flood Insurance Study or on the Flood Insurance Rate Map (FIRM).

[BS] FLOODWAY. The channel of the river, creek or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height as designated on a community's flood hazard map, or otherwise legally designated, including areas shown in either the Flood Insurance Study or on the Flood Insurance Rate Map (FIRM).

[IBC] SPECIAL FLOOD HAZARD AREA. The land area subject to flood hazards and shown on a Flood Insurance Rate Map or ~~other flood hazard map~~ the Flood Insurance Study as Zone A, AE, A1-30, A99, AR, AO, AH, V, VO, VE or V1-30.

[BS] SUBSTANTIAL IMPROVEMENT. Any repair, reconstruction, rehabilitation, alteration, addition, or other improvement of a building or structure or a portion thereof the cost of which equals or exceeds 50 percent of the market value of the building or structure before the improvement or repair is started. If the structure has sustained substantial damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The term does not, however, include either the following:

1. Any project for improvement of a building or a structure or portion thereof required to correct existing health, sanitary, or safety code violations identified by the building official and that is the minimum necessary to assure safe living conditions; or
2. Any alteration of a historic structure, provided that the alteration will not preclude the building or structure's continued designation as a historic building or structure; or
3. Any improvements necessary with elevating a structure above the design flood elevation; or
4. Buildings or structures located outside of the special flood hazard area but within a locally designated flood hazard area or flood and coastal wind resilience area, if the locality's regulatory standards specifically exempt such locally designated flood hazard area from the substantial improvement provisions of the VCC, or from any other locally adopted substantial improvement requirement.

[IBC] 802.4 Applicability. For buildings in flood hazard areas as established in Section 1612.3, interior finishes, trim and decorative materials below the design flood elevation required by Section 1612 shall be flood-damage-resistant materials.

[IBC] 1603.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.4, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. Flood design class assigned according to ASCE 24.
2. In *flood hazard areas* other than *Coastal High Hazard Areas* or *Coastal A Zones*, the elevation of the proposed lowest floor, including the basement.
3. In *flood hazard areas* other than *Coastal High Hazard Areas* or *Coastal A Zones*, the elevation to which any nonresidential building will be dry floodproofed.
4. In *Coastal High Hazard Areas* and *Coastal A Zones*, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement, or the grade beam if not located below the depth of anticipated scour/erosion as determined by the 1% annual chance coastal flood event caused by the combined effects of wind and water loads acting simultaneously on all building components in accordance with ASCE 7-10, Minimum Design Loads for Buildings and Other Structures.

[IBC] 1612.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official **on an approved National Flood Insurance Program Elevation Certificate (FEMA Form 086-0-33):**

1. For construction in flood hazard areas other than *Coastal High Hazard Areas* or *Coastal A Zones*:
 - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 113.3.2 and for the final inspection in Section 113.3.
 - 1.2. For fully enclosed areas below the *design flood elevation* where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.
 - 1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24.
2. For construction in *Coastal High Hazard Areas* or *Coastal A Zones*:
 - 2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.10.1.
 - 2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.
 - 2.3. ~~For b₂ breakaway walls are prohibited designed to have a resistance of more than 20 psf (0.96 kN/m²) determined using allowable stress design, construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.~~

[IBC] 1805.1.2.1 Flood hazard areas. For buildings and structures in flood hazard areas as established in Section 1612.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on at least one side.

~~Exception: Under floor spaces of Group R-3 buildings that meet the requirements of FEMA~~

~~FB 11.~~

USBC - Virginia Residential Code

Modify the Definitions in Part II to read as follows:

DESIGN FLOOD ELEVATION. The elevation of the “design flood,” including wave height, relative to the datum specified on the community’s legally designated flood hazard map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the *building’s* perimeter plus the depth number, in feet, plus 3 feet (915 mm) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2.5 feet (1525 ~~610~~ mm).

FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a floodplain subject to a 1 percent or greater chance of flooding in any given year (also known as the 100-year floodplain).
2. This area designated as a *flood hazard area* on a community’s flood hazard map, or otherwise legally designated, including areas shown in either the *Flood Insurance Study* or on the *Flood Insurance Rate Map (FIRM)* and including areas added to account for future flooding conditions based on the locally adopted sea level rise projected to occur by 2070.

R322.1.3 Flood-resistant construction. Buildings and structures erected in areas prone to flooding shall be constructed by methods and practices that minimize flood damage in accordance with FEMA TB-2 and ASCE 24.

R322.1.5 Lowest floor. The lowest floor shall be the lowest floor of the lowest enclosed area, including basement, and excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited (200 square feet or less) storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

R322.1.6 Protection of mechanical, plumbing and electrical systems. Electrical systems, *equipment* and components; heating, ventilating, air conditioning; plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall be located at or above the elevation required in Section R322.2 or R322.3. If replaced as part of a substantial improvement, electrical systems, *equipment* and components; heating, ventilating, air conditioning and plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall meet the requirements of this section. Systems, fixtures, and *equipment* and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

Exception: ~~Locating electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment is permitted below the elevation required in Section R322.2 or R322.3 provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in accordance with ASCE 24.~~ Electrical wiring systems are permitted to be located below the required elevation provided that they conform to the provisions of the electrical part of this code for wet locations in accordance with FEMA P-348.

R322.1.8 Flood-resistant materials. Building materials and installation methods used for flooring and interior and exterior walls and wall coverings below the elevation required in Section R322.2 or R322.3 shall be flood damage-resistant materials that conform to the provisions of FEMA TB-2 and ASCE 24.

R322.1.9 Manufactured homes. The bottom of the frame of new and replacement *manufactured homes* on foundations that conform to the requirements of Section R322.2 or R322.3, as applicable, shall be elevated to or above the design flood elevations specified in Section R322.2 (flood hazard areas including A Zones) or R322.3 in *Coastal High Hazard Areas* (V Zones and *Coastal A Zones*). The anchor and tie-down requirements of the applicable state or federal requirements shall apply. The foundation and anchorage of *manufactured homes* to be located in identified floodways shall be designed and constructed in accordance with ASCE 24.

R322.2 Flood hazard areas (including A Zones). Areas that have been determined to be prone to flooding and that are not subject to high-velocity wave action shall be designated as flood hazard areas. Flood hazard areas that have been delineated as subject to wave heights between greater than or equal to 1 1/2 feet (457 mm cm) and 3 feet (914 mm) or otherwise designated by the jurisdiction ~~shall be~~ are designated as either Coastal A Zones or V, VE or V1-30 Zones and are subject to the requirements of Section R322.3. Buildings and structures constructed in whole or in part in flood hazard areas shall be designed and constructed in accordance with Sections R322.2.1 through R322.2.3.

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas not designated as Coastal A Zones, shall have the lowest floors elevated to or above either the base flood elevation plus ~~1 foot 3 feet (305 915 mm)~~, or the *design flood elevation*, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated to a height above the highest adjacent grade of not less than the depth number specified in feet (mm) on the FIRM plus ~~1 foot 3 feet (305 915 mm)~~, or not less than ~~3 5 feet (915 1525 mm)~~ if a depth number is not specified.

3. Basement floors that are below grade on all sides ~~are prohibited shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.~~
4. Garage and carport floors shall comply with one of the following:
 - 4.1. They shall be elevated to or above the elevations required in Item 1 or Item 2, as applicable.
 - 4.2. They shall be at or above grade on not less than one side. Where a garage or carport is enclosed by walls, the garage or carport shall be used solely for parking, building access or storage and the walls shall be constructed of flood resistant materials.

Exception: Enclosed areas below the elevation required by this section, including basements with floors that are not below grade on all sides, shall meet the requirements of Section R322.2.2.

R322.2.2 Enclosed area below design flood elevation. Enclosed areas, including crawl spaces, that are below the *design flood elevation* shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria and are installed in accordance with Section R322.2.2.1:
 - 2.1. The total net area of nonengineered flood openings shall be not less than 1 square inch (645 mm²) for each square foot (0.093 m²) of enclosed area where the enclosed area is measured on the exterior of the enclosure walls, or the flood openings shall be designed as engineered flood openings and the *construction documents* shall include a statement by a registered *design professional* that the design of the flood openings will provide for equalization of hydrostatic flood forces on *exterior walls* by allowing for the automatic entry and exit of floodwaters as specified in Section 2.6.2.2 of ASCE 24 and in FEMA TB-1.
 - 2.2. Flood openings shall be not less than 3 inches (~~76 mm~~ 8 cm) in any direction in the plane of the wall.
 - 2.3. The presence of louvers, blades, screens and faceplates or other covers and devices shall allow the automatic flow of floodwater into and out of the enclosed areas and shall be accounted for in the determination of the net open area.

R322.2.2.1 Installation of openings. The walls of enclosed areas shall have flood openings installed such that:

1. There shall be not less than two openings on different sides of each enclosed area; if a building has more than one enclosed area below the *design flood elevation*, each area shall have flood openings.
2. The bottom of each flood openings shall be not more than 1 foot (~~305 mm~~ cm) above the higher of the final interior grade or floor ~~and or~~ the finished exterior grade immediately under each flood openings.

3. Flood Openings shall be permitted to be installed in doors and windows; doors and windows without installed flood openings do not meet the requirements of this section.

R322.3.1 Location and site preparation.

1. New buildings and buildings that are determined to be substantially improved pursuant to Section R105.3.1.1 shall be located landward of the reach of mean high tide.
2. For any alteration of sand dunes and mangrove stands, the building official shall require submission of an engineering analysis and a satisfactory Comment Document from FEMA for a Conditional Letter of Map Revision (CLOMR) that demonstrates that the proposed alteration will not increase the potential for flood damage.

R322.3.3 Foundations. Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns.

1. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.5.
2. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling.
3. Columns and their supporting foundations shall be designed to resist combined wave and wind loads, lateral and uplift, and shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the columns. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24. Grade beams shall be located below the lowest expected eroded surface.
4. Flood and wave loads shall be associated with the design flood. Wind loads shall be those required by this code.
5. Foundation designs and construction documents shall be prepared and sealed in accordance with Section R322.3.9.

~~**Exception:** In Coastal A Zones, stem wall foundations supporting a floor system above and backfilled with soil or gravel to the underside of the floor system shall be permitted provided the foundations are designed to account for wave action, debris impact, erosion~~

~~and local scour. Where soils are susceptible to erosion and local scour, stem wall foundations shall have deep footings to account for the loss of soil.~~

R322.3.5 Walls below *design flood elevation*. Walls and partitions ~~are permitted~~ below the elevated floor ~~are prohibited in Coastal A Zones or Coastal High Hazard Areas,~~ provided that such walls and partitions are not part of the structural support of the building or structure and:

- ~~1. Electrical, mechanical and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and~~
- ~~2. Are constructed with insect screening or open lattice; or~~
- ~~3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a resistance of not less than 10 (479 Pa) and not more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or~~
- ~~4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), as determined using allowable stress design, the *construction documents* shall include documentation prepared and sealed by a registered *design professional* that: 4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the base flood. 4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on structural and nonstructural building components. Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code.~~
- ~~5. Walls intended to break away under flood loads as specified in Item 3 or 4 have flood openings that meet the criteria in Section R322.2.2, Item 2.~~

R322.3.6 Enclosed areas below *design flood elevation*. Enclosed areas below the *design flood elevation* ~~in Coastal A Zones or Coastal High Hazard Areas are prohibited~~ shall be used solely for parking of vehicles, building access or storage.

R322.3.6.1 Protection of building envelope. An exterior door that meets the requirements of Section R609 shall be installed at the top of stairs that provide access to the building ~~and that are enclosed with walls designed to break away in accordance with Section R322.3.4.~~

R322.3.10 Tanks. Underground tanks ~~are prohibited in Coastal A Zones or Coastal High Hazard Areas~~ shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the *design flood* elevation required in Section R322.3.2. Where elevated on platforms, the platforms shall be cantilevered from or knee braced to the building or shall be supported on foundations that conform to the requirements of Section R322.3.

USBC - Virginia Existing Building Code

102.2 Scope. The provisions of this code shall govern construction and rehabilitation activities in existing buildings and structures except in locally designated flood and coastal wind hazard resilience areas (see section 102.2.4 below).

102.2.4 Reconstruction, alteration or repair in locally-designated flood and coastal wind hazard resilience areas. Within flood and coastal wind hazard resilience areas, existing development in coastal areas of the Commonwealth related to tropical cyclones, Nor'easters, high-tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea-level rise shall be discouraged whenever opportunities arise. This shall require that for any reconstruction, alteration or repair of an existing building within Resilience Areas, the resulting structure shall be stronger, more resilient and less subject to risks from flooding and high winds than was the case prior to work commencing. The following shall be included in flood and coastal wind resilience areas:

1. A sea level rise factor shall be incorporated into plans for all existing structures that are proposed to be reconstructed, altered or repaired subject to the Code. At a minimum, the factor shall consider 30 years of projected sea level rise using a locally adopted method. In the absence of a locally adopted method, the design of such structures shall include two feet (60 cm) of sea level rise plus three feet (90 cm) of freeboard to the lowest habitable floor elevation.
2. The mandated use of FEMA Technical Bulletin Best Practices for coastal construction shall be permitted within resilience areas.
3. The mandated use of recognized performance- and resilience-based codes shall be permitted within resilience areas, provided that the relevant portions of such codes are used in their entirety.

103.9 Construction documents. Construction documents shall be submitted with the application for a permit. The work proposed to be performed on an existing building or structure shall be classified on the construction documents as repairs, alterations, change of occupancy, addition, historic building, or moved building. Alterations shall further be classified as Level 1 or Level 2. Any required flood elevation certificate shall be prepared by a certified land surveyor or registered professional engineer licensed in Virginia.

Exception: Construction documents or classification of the work does not need to be submitted when the building official determines the proposed work does not require such documents, classification, or identification.

VEBC Chapter 2 Definitions:

Add the following definition to read and provide as follows:

FLOOD AND COASTAL WIND HAZARD RESILIENCE AREAS. A designation in the local government comprehensive plan of coastal communities in the Commonwealth which identifies

one or more areas that experience coastal flooding due to extreme high tides and storm surge, tropical cyclones, Nor'easters, flash floods, stormwater runoff and that are vulnerable to the related impacts of rising sea level for the purpose of prioritizing funding for infrastructure needs and adaptation planning, including establishment of higher standards for building construction, reconstruction, alteration and repair within the Resilience Area. Examples of Flood and Coastal Wind Resilience Areas may include, but are not limited to designated floodplains and special flood hazard areas, Chesapeake Bay Preservation Areas, designated evacuation zones and routes, areas determined by modelling to be at risk from recurrent flooding resulting from sea level rise within fifty years, areas within 1000 feet of the coastline of the ocean, bay or estuarian reach of a tidal river and other similar areas designated within the local comprehensive plan. Any locality in Coastal Virginia may adopt *Flood and Coastal Wind Hazard Resilience Areas* but shall not be obligated to do so.

Modify the following definition to read and provide as follows:

SUBSTANTIAL IMPROVEMENT. For the purpose of determining compliance with the flood provisions of this code, any improvement, including repair, reconstruction, rehabilitation, alteration, or addition, or other improvement of a building or structure or a portion thereof, located within a flood hazard area or special flood hazard area or flood and coastal wind resilience area, the cost of which equals or exceeds 50% of the market value of the building or structure before the improvement or repair is started. If the building or structure or portion thereof has sustained substantial damage, any improvements are considered substantial improvements regardless of the actual improvement performed. The term does not, however, include either:

1. Any project for improvement of a building or a structure or portion thereof required to correct existing health, sanitary, or safety code violations identified by the building official and that is the minimum necessary to assure safe living conditions; or
2. Any alteration of a historic structure, provided that the alteration will not preclude the building or structure's continued designation as a historic building or structure.
3. Buildings or structures located outside of the special flood hazard area but within a flood hazard area or flood and coastal wind resilience area designated by the locality, if the locality's regulatory standards specifically exempt such flood hazard area from the substantial improvement provisions of the VEBC, or from any other locally adopted substantial improvement requirement.
4. Any improvements necessary with elevating a structure above the design flood elevation.

S63-22

IBC: CHAPTER 2, SECTION 202, CHAPTER 16, SECTION 1602, 1602.1, SECTION 1603, 1603.1.4, SECTION 1605, 1605.1, SECTION 1607, 1607.14, 1607.14.3, SECTION 1609, 1609.5 (New), 1609.5, 1609.5.1, 1609.5.2, 1609.6.3 (New), 1609.5.3, 1609.6.3.2 (New), CHAPTER 23, SECTION 2308, 2308.2.3, ASCE/SEI Chapter 35 (New)

Proponents: Jennifer Goupil, representing Structural Engineering Institute of ASCE (jgoupil@asce.org); Marc Levitan, National Institute of Standards and Technology, representing NIST (marc.levitan@nist.gov); Pataya Scott, representing Federal Emergency Management Agency (pataya.scott@fema.dhs.gov)

2021 International Building Code

CHAPTER 2 DEFINITIONS

SECTION 202 DEFINITIONS

Revise as follows:

[BS] NOMINAL LOADS. The magnitudes of the *loads* specified in Chapter 16 (dead, live, soil, wind, tornado, snow, rain, *flood* and earthquake).

[BS] ESSENTIAL FACILITIES. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from *flood*, wind, tornadoes, snow or earthquakes.

[BS] RISK CATEGORY. A categorization of buildings and *other structures* for determination of *flood*, wind, tornado, snow, ice and earthquake *loads* based on the risk associated with unacceptable performance.

CHAPTER 16 STRUCTURAL DESIGN

SECTION 1602 NOTATIONS

Revise as follows:

1602.1 Notations. The following notations are used in this chapter:

D	=	Dead load.
D_i	=	Weight of ice in accordance with Chapter 10 of ASCE 7.
E	=	Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4 of ASCE 7.
F	=	Load due to fluids with well-defined pressures and maximum heights.
F_a	=	Flood load in accordance with Chapter 5 of ASCE 7.
H	=	Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.
L	=	Live load.
L_r	=	Roof live load.
R	=	Rain load.
S	=	Snow load.
T	=	Cumulative effects of self-straining load forces and effects.
V_{asd}	=	Allowable stress design wind speed, miles per hour (mph) (km/hr) where applicable.
V	=	Basic design wind speeds, miles per hour (mph) (km/hr) determined from Figures 1609.3(1) through 1609.3(12) or ASCE 7.
V_T	=	Tornado speed, miles per hour (mph) (m/s) determined from Chapter 32 of ASCE 7.
W	=	Load due to wind pressure.
W_i	=	Wind-on-ice in accordance with Chapter 10 of ASCE 7.

SECTION 1603

CONSTRUCTION DOCUMENTS

Revise as follows:

1603.1.4 Wind and tornado design data. The following information related to wind and tornado loads shall be shown, regardless of whether wind or tornado loads govern the design of the lateral force-resisting system of the structure:

1. Basic ~~design wind speed, V (mph),~~ tornado speed, V_T (mph), ~~miles per hour~~ and allowable stress design wind speed, V_{asd} (mph), as determined in accordance with Section 1609.3.1.
2. Risk category.
3. Effective plan area, A_e , for tornado design in accordance with Chapter 32 of ASCE 7.
- ~~3-4.~~ Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
- ~~4-5.~~ Applicable internal pressure coefficients, and applicable tornado internal pressure coefficients.
- ~~5-6.~~ Design wind pressures and their applicable zones with dimensions to be used for exterior component and cladding materials not specifically designed by the registered design professional responsible for the design of the structure, pounds per square foot (kN/m²). Where design for tornado loads is required, the design pressures shown shall be the maximum of wind or tornado pressures.

SECTION 1605 LOAD COMBINATIONS

Revise as follows:

1605.1 General. Buildings and *other structures* and portions thereof shall be designed to resist the strength load combinations specified in ASCE 7, Section 2.3, the *allowable stress design* load combinations specified in ASCE 7, Section 2.4, or the alternative *allowable stress design* load combinations of Section 1605.2.

Exceptions:

1. The modifications to load combinations of ASCE 7 Section 2.3, ASCE 7 Section 2.4, and Section 1605.2 specified in ASCE 7 Chapters 18 and 19 shall apply.
2. Where the allowable stress design load combinations of ASCE 7 Section 2.4 are used, flat roof snow *loads* of 30 pounds per square foot (1.44 kN/m²) and *roof live loads* of 30 pounds per square foot (1.44 kN/m²) or less need not be combined with seismic load. Where flat roof snow *loads* exceed 30 pounds per square foot (1.44 kN/m²), 20 percent shall be combined with seismic loads.
3. Where the allowable stress design load combinations of ASCE 7 Section 2.4 are used, crane hook loads need not be combined with *roof live loads* or with more than three-fourths of the snow load or one-half of the wind loads.
4. Where tornado loads are required, the alternative allowable stress design load combinations of Section 1605.2 shall not apply when tornado loads govern the design.

SECTION 1607 LIVE LOADS

Revise as follows:

1607.14 Roof loads. The structural supports of roofs and *marquees* shall be designed to resist wind and, where applicable, tornado and snow and earthquake *loads*, in addition to the *dead load* of construction and the appropriate *live loads* as prescribed in this section, or as set forth in Table 1607.1. The *live loads* acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.14.3 Awnings and canopies. *Awnings* and canopies shall be designed for uniform *live loads* as required in Table 1607.1 as well as for snow *loads* and wind and tornado loads as specified in Sections 1608 and 1609.

SECTION 1609 WIND LOADS

Add new text as follows:

1609.5 Tornado Loads. The design and construction of Risk Category III and IV buildings and other structures located in the tornado-prone region as shown in Figure 1609.5 shall be in accordance with Chapter 32 of ASCE 7, except as modified by this code.



FIGURE 1609.5 TORNADO-PRONE REGION

Revise as follows:

~~1609.5~~ **1609.6 Roof systems.** Roof systems shall be designed and constructed in accordance with Sections ~~1609.5.1~~ 1609.6.1 through ~~1609.5.3,~~ 1609.6.3 as applicable.

~~1609.5.1~~ **1609.6.1 Roof deck.** The *roof deck* shall be designed to withstand the greater of wind pressures or tornado pressures determined in accordance with ASCE 7.

~~1609.5.2~~ **1609.6.2 Roof coverings.** *Roof coverings* shall comply with Section ~~1609.5.1~~ 1609.6.1.

Exception: Rigid tile *roof coverings* that are air permeable and installed over a *roof deck* complying with Section ~~1609.5.1~~ 1609.6.1 are permitted to be designed in accordance with Section 1609.5.6.3.

Asphalt shingles installed over a *roof deck* complying with Section ~~1609.5.1~~ 1609.6.1 shall comply with the wind-resistance requirements of Section 1504.2 .

Add new text as follows:

1609.6.3 Rigid Tile . Wind and tornado loads on rigid tiles shall comply with Sections 1609.6.3.1 or 1609.6.3.2, as applicable.

Revise as follows:

~~1609.5.3~~ **1609.6.3.1 Rigid tile-Wind loads.** Wind *loads* on rigid tile *roof coverings* shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - GC_p] \quad \text{(Equation 16-18)}$$

For SI:

$$M_a = \frac{q_h C_L b L L_a [1.0 - GC_p]}{1,000}$$

where:

b = Exposed width, feet (mm) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1504.3.1.

GC_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

L = Length, feet (mm) of the roof tile.

L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

M_a = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.

q_h = Wind velocity pressure, psf (kN/m²) determined from Section 26.10.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, *mortar* set or adhesive set.
2. The roof tiles shall be installed on solid sheathing that has been designed as components and cladding.
3. An *underlayment* shall be installed in accordance with Chapter 15.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using *mortar* set or adhesive set systems shall have not less than two-thirds of the tile's area free of *mortar* or adhesive contact.

Add new text as follows:

1609.6.3.2 Tornado Loads. Tornado loads on rigid tile roof coverings shall be determined in accordance with Section 1609.6.3.1, replacing q_h with q_{hT} and (GC_p) with $K_{VT}(GC_p)$ in Equation 16-18, where:
 q_{hT} = tornado velocity pressure, psf (kN/m²) determined in accordance with Section 32.10 of ASCE 7.

K_{VT} = tornado pressure coefficient adjustment factor for vertical winds, determined in accordance with Section 32.14 of ASCE 7.

CHAPTER 23 WOOD

SECTION 2308 CONVENTIONAL LIGHT-FRAME CONSTRUCTION

Revise as follows:

2308.2.3 Allowable loads. *Loads* shall be in accordance with Chapter 16 and shall not exceed the following:

1. Average *dead loads* shall not exceed 15 psf (718 N/m²) for combined roof and ceiling, *exterior walls*, floors and partitions.

Exceptions:

1. Subject to the limitations of Section 2308.6.10, stone or masonry *veneer* up to the less of 5 inches (127 mm) thick or 50 pounds per square foot (2395 N/m²) and installed in accordance with Chapter 14 is permitted to a height of 30 feet (9144 mm) above a noncombustible foundation, with an additional 8 feet (2439) permitted for *gable* ends.
2. Concrete or masonry fireplaces, heaters and chimneys shall be permitted in accordance with the provisions of this code.

2. *Live loads* shall not exceed 40 psf (1916 N/m²) for floors.

Exception: *Live loads* for concrete slab-on-ground floors in *Risk Categories* I and II shall be not more than 125 psf.

3. Ground snow *loads* shall not exceed 50 psf (2395 N/m²).
4. Tornado loads on the main wind force resisting system and all components and cladding shall not exceed the corresponding wind loads on these same elements

Add new standard(s) as follows:

ASCE/SEI

American Society of Civil Engineers Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191

edition as an Administrative update in the 2024 I-Codes.

This proposal includes technical updates as well as editorial coordination. The specific changes to each section included in this proposal is outlined below, and a detailed summary of the technical updates are explained below that:

Section 202 Definitions: Updates to **Nominal Loads**, **Essential Facilities**, and **Risk Category** to include tornadoes.

Section 1602.1 Notations: Add new term V_T for tornado speeds.

Section 1603.1.4 Wind design data: Modifies section to include tornado speed and applicable internal pressures to be included on the construction drawings.

Section 1605.1 General: Adds new Exception 4 to exclude the use of the Alternative allowable stress design load combinations in Section 1605.2 when tornado loads govern the design.

Section 1607.14 Roof loads; Section 1607.14.3 Awnings and canopies: Modifies section to include tornado.

Section 1609.5 Tornado Loads: Added new section for charging language for tornado loads as well as a new **Figure 1609.5 Tornado Prone Region** to determine where tornado loads must be considered, per ASCE 7-22 Chapter 32.

Section 1609.5 Roof systems: This is to update the section number to 1609.6 after adding the new section 1609.5 for Tornado loads.

Section 1609.5.1 Roof deck: This updates to the new section number of 1609.6.1 and clarifies the requirement to be the greater of wind or tornado pressures for roof deck design.

Section 1609.5.2 Roof coverings: This updates the new section number 1609.6.2 as well as updates the pointers to the new section numbers.

Section 1609.5.3 Rigid Tile: This updates to the new section number of 1609.6.3 as well as adds new section **1609.6.3.1 Wind loads** and **1609.6.3.2 Tornado loads** to differentiate the requirements for wind and tornado. Also the new section 1609.6.3.2 for tornado loads clarifies the terms to be used in Equation 16-18 as well as adds pointers to ASCE 7 Chapter 32. [NOTE TO EVERYONE: cdpAccess would not permit me to strikeout the redundant "Section 1609.5.3 Rigid Tile" following the new section "Section 1609.6.3.1 Wind Loads" shown in the PDF of this proposal. My intention is to strike out "~~Section 1609.5.3 Rigid Tile~~" but cannot in cdpAccess at the time of this submittal.]

Section 2308.2.3 Allowable loads: This adds a requirement that allowable loads for conventional light-frame construction shall not be used on any portion of the design where tornado loads govern. This is written to specifically address only the portions of the design - specific to each element - where the loads are governed by tornado loads and does not intend to exclude the rest of the project that is not governed by tornado loads.

TECHNICAL REASON STATEMENT:

Overview

Tornado hazards have not previously been considered in the design of conventional buildings, despite the fact that tornadoes and tornadic storms cause more fatalities than hurricanes and earthquakes combined (NIST 2014) and more catastrophe insured losses than hurricanes and tropical storms combined (Insurance Information Institute 2021). This gap is addressed for the first time in ASCE 7-22, which now includes requirements for tornado loads. The tornado hazard maps and load methodology are based on a decade of research and development led by the National Institute of Standards and Technology (NIST), in collaboration with ASCE, following the record 2011 tornado season (1,691 tornadoes causing 553 fatalities). ASCE 7-22 requirements for tornado loads apply to Risk Category III and IV buildings and other structures sited in the tornado-prone region, which is approximately equal to the area of the U.S. east of the Continental Divide.

The tornado loads specified in the new Chapter 32 provide reasonable consistency with the reliability delivered by the existing criteria in ASCE 7 Chapters 26 and 27 for the Main Wind Force Resisting System (MWFRS), using the same return periods as the basic wind speed maps in Chapter 26 for Risk Category III and IV facilities (1,700 and 3,000 years, respectively). At return periods of 300 and 700 years (used for wind speeds with Risk Category I and II structures), tornado speeds are generally so low that tornado loads will not control over Chapter 26 wind loads. Therefore, design for tornadoes is not required for Risk Category I and II buildings and other structures.

ASCE 7-22 tornado design speeds for Risk Category III and IV structures range from 60 to 138 mph, depending on geographic location, Risk Category, and effective plan area (which is a function of the building footprint size and shape). This approximately corresponds to the speeds for Enhanced Fujita Scale EF0- EF2 tornadoes, which are not the most intense tornadoes but they are the most common. During the period from 1995 to 2016, over 89% of all reported tornadoes were EF0-EF1, and 97% were in the range of EF0-EF2. Furthermore, most of the area impacted by a tornado does not experience the maximum winds speeds on which the tornado is rated. For example, in the 2011 EF-5 tornado that damaged or destroyed approximately 8,000 buildings in Joplin, Missouri, an estimated 72% of the area swept by the tornado experienced EF0-EF2 winds, while just 28% experienced EF3 and greater winds (NIST 2014). It should also be noted that while property losses per individual tornado increase

dramatically with increasing EF number, the aggregate losses caused by all EF1 tornadoes are very similar in magnitude to aggregate losses for all EF2s, for all EF3s, for all EF4s, and for all EF5s (NIST 2014). This is due to the fact that there are so many more lower-intensity tornadoes; e.g., only 59 of the nearly 66,000 recorded tornadoes since 1950 have been rated as EF-5.

To make it very clear that the ASCE 7 tornado provisions are not intended to provide protection from the most violent tornadoes, a large User Note on the first page of the Tornado Load chapter advises readers as follows:

Options for protection of life and property from more intense tornadoes include construction of a storm shelter and/or design for longer-return-period tornado speeds as provided in Appendix G, including performance-based design. A building or other structure designed for tornado loads determined exclusively in accordance with Chapter 32 cannot be designated as a storm shelter without meeting additional critical requirements provided in the applicable building code and ICC 500, the ICC/NSSA Standard for the Design and Construction of Storm Shelters. See Commentary Section C32.1.1 for an in-depth discussion on storm shelters. (ASCE 7-22 Section 32.1.1)

The referenced commentary section explains that life safety protection against the most violent tornadoes requires a tornado shelter that meets the *ICC 500 Standard for Design and Construction of Storm Shelters* (ICC 2020), or a tornado safe room meeting FEMA P-361 guidelines (FEMA 2021; note that Safe Rooms must meet all ICC 500 requirements plus additional FEMA Funding Criteria). Tornado hazard criteria for ICC 500 and FEMA P-361 are much more stringent than ASCE 7, reflecting the purpose to provide 'near-absolute life safety protection' as described by FEMA (2021). For example, the tornado shelter design speed in the central US is 250 mph. This compares to ASCE 7 speeds of 78-124 mph for Risk Category III and 95-138 mph for Risk Category IV, where the lower and upper values in the ranges correspond to 1 ft² and 4 million ft² effective plan areas, respectively.

Tornado Hazards

Among the many reasons that building codes and standards have not previously required design for tornado hazards is the misperception that tornadoes are too rare. As seen in Figure 1, in recent decades there have been an average of 1,251 *reported* tornadoes per year. The apparent smaller numbers of tornadoes from the 1950s through the early 1990s is primarily due to reporting issues, before there were doppler radar networks, cell phones, and trained spotter networks. Even today, many tornadoes in areas of low population density go unreported, in a well-known effect called *population bias*. There are less tornadoes per square mile per year recorded in very rural areas compared to suburban and urban areas in the same region of the country. The average annual frequency of tornadoes per state is shown in Figure 2, with the majority of tornadoes occurring in the Central and Southeast states.

Although the peak months for tornado activity in the US are in the spring, tornadoes can and do occur year-round. The end of 2021 yielded a record-setting December. The "Quad-State Tornado Outbreak" on December 10-11 spawned 68 tornadoes across 10 states, including two that tracked for more than 100 miles. This outbreak caused 90 confirmed fatalities. "The total damages and economic losses resulting from the historic tornado outbreak that impacted multiple states from the South to the Midwest could amount to \$18 billion, which would make it the costliest tornado outbreak in U.S. history," (AccuWeather 2021). The day after AccuWeather published that loss estimate, a derecho over the upper Midwest on December 15-16 caused another outbreak of 94 tornadoes. December yielded a total of 193 tornadoes across the Midwest and Southeast, including 42 EF-0, 96 EF-1, 42 EF-2, 6 EF-3, and 2 EF-4 tornadoes, with 5 more rated as unknown intensity (Figure 3).

While tornadoes have been recorded in all 50 states, the overwhelming majority occur east of the Continental Divide as seen in Figure 4. Even from this raw data, it is apparent why the tornado prone-region is east of the Rocky Mountains. The most intense tornadoes, shown in the darker colors, generally occur in the Central US, except near the Gulf Coast. Similarly, there are fewer intense tornadoes along the Atlantic Coast states. The coastal states have a large number of lower intensity tornadoes, many of them generated by hurricanes. In comparison, the Mountain and Western States experience relatively few tornadoes, and almost no strong (EF2-EF3) or violent (EF4-EF5) tornadoes.

Tornadoes can vary significantly in size. Path lengths range from as short as tens of yards to over a hundred miles. December's Quad-State Tornado tracked 166 miles across Arkansas, Missouri, Tennessee and Kentucky over the span of 4 hours. It was the 9th longest tornado on record (the longest being 219 miles). Path widths vary from around 10 yards to over a mile. The widest tornado on record occurred in El Reno, Oklahoma in 2013, with a maximum path width of 2.6 miles. The average path length for the December 2021 tornadoes was 8.8 miles, while the average maximum path width was 184 yards (Figure 3).

It is clear from the climatology that tornadoes are not rare events. For example, Oklahoma City has been struck by at least 141 tornadoes since 1940, for an average of nearly 2 per year (NWS 2022a). Another way to understand how frequent tornadoes actually are is to consider them from a building impacts perspective. Mining of event and episode narratives from NOAA's National Centers for Environmental Information (NCEI) Storm Events Database from 1993-2020 indicated at least 647 reports of schools being struck by tornadoes. Figure 5 shows the number of preK-12 schools per state that were struck by tornadoes. This average of more than 23 schools per year is a lower bound. The purpose of the Storm Events Database narratives is not to document school impacts per se, but rather summarize key features of storm and its overall impacts. Schools are often mentioned, but this is by no means a complete data source for school strikes. Review of other databases, post-storm reports, news searches, and other sources of information revealed many additional schools that were struck by tornadoes during this time period.

One recent example school impact: in a terrible way to ring in the new year, Veterans Memorial Middle School in Covington, Georgia was struck by

an EF-1 tornado on December 31, 2021 (Figure 6). According to the National Weather Service, which conducted its assessment on New Year's Day, structural damage was observed at the school (NWS 2022b). "The tornado reached peak intensity of 90 mph as it hit Veterans Middle School removing significant amounts of siding and roofing from the gymnasium and sections of roof."

Tornado Load Provisions

The commentary chapter C32 of ASCE 7-22 provides descriptions and references supporting the development and application of the tornado load provisions. A brief summary is provided below.

Introduction. The tornado hazard maps and load methodology were developed over the course of a decade of R&D by the National Institute of Standards and Technology, working closely with Applied Research Associates, Inc. and ASCE. The ASCE 7 tornado load provisions were developed by the ASCE 7 Tornado Task Committee in cooperation with the ASCE 7 Wind Load and Load Combinations Subcommittees. Three workshops were held (two at ASCE headquarters, in September 2015 and May 2019) in support of the tornado hazard map development. A broad range of stakeholders were informed about the detailed plans for map development at the first two workshops and advised on the details of the final methodology and draft maps at the last workshop. Stakeholder feedback from all workshops was incorporated into the final tornado hazard maps and load methodology.

Incorporation of Tornado Loads in ASCE 7. Tornado loads are treated completely separately from wind loads, hence their inclusion in a new chapter. While tornadoes are a type of windstorm, there are significantly different characteristics between tornadoes and other windstorms. For instance, tornadic winds have significant updrafts near the core; rapid atmospheric pressure changes can induce loads; and load combinations including tornado loads are not always the same as those including other wind loads (e.g., tornadoes are warm weather phenomena, so snow loads would not be included in combination with tornado loads). As a result of these considerations, tornado loads are treated separately from wind loads, not as a subset of wind loads. This is analogous to the separate treatment of flood loads and tsunami loads; both are hydrodynamic loads on buildings, but the nature of the hazard and the hazard-structure interaction is different enough that they are considered as completely separate loads.

Tornado Load Procedures. The tornado load procedures are based on the overall framework of the ASCE 7 wind load procedures. Tornado velocity pressure and design pressure/design load equations are similar to those found in Chapters 26-31 (exclusive of Chapter 28 Envelope Procedure, where the underlying methodology is incompatible with the tornado load approach). However, most of the terms used in the tornado load equations have some differences compared to their wind load counterparts, reflecting the unique characteristics of tornadic winds and wind-structure interaction in contrast to straight-line winds. Several wind load parameters are not used in the tornado load chapter, while Chapter 32 also introduces a few new and significantly revised parameters.

Tornado Hazard Maps. Critical to development of the entire tornado load methodology was creation of a new generation of tornado hazard maps. The R&D needed to create these maps broke new ground in a number of areas. For example, novel approaches to quantify the well-known problems of population bias (where more tornadoes are reported in areas having greater population) and to capture regional variation in tornado climate were developed and applied. Tornado wind speeds associated with the Enhanced Fujita (EF) Scale intensity ratings were derived through engineering analysis instead of relying on the original EF Scale methodology, which was based on expert elicitation. The tornado hazard maps take spatial effects into account (since larger buildings are more likely to be struck by a tornado, tornado wind speeds increase with increasing plan (i.e., footprint) area of the building). These efforts resulted in a set of state-of-the-art probabilistic tornado hazard maps prescribing tornado design wind speeds for a wide range of return periods and target building plan area sizes, enabling tornado-resistant design of conventional buildings and infrastructure, including essential facilities.

The mapped tornado speeds represent the maximum 3-s gust produced by the translating tornado at a height of 33 ft anywhere within the plan area of the target building. The design tornado speeds for Risk Category III and IV buildings (for 1,700- and 3,000-year return periods, respectively) typically range from EF0-EF2 intensity, depending on geographic location, Risk Category, and plan size and shape. For protection from more violent tornadoes, performance-based design is explicitly allowed, and commentary on additional design requirements for storm shelters is provided. An appendix is included with tornado speeds for longer return periods. At return periods of 300 and 700 years, tornado speeds are generally so low that tornado loads will not control over Ch. 26 wind loads, hence design for tornadoes is not required for Risk Category I and II buildings and other structures.

Tornado Velocity Pressure. While the effects of terrain and topography on tornado wind speed profiles are not yet well understood, a review of near-surface tornadic wind measurements from mobile research radar platforms plus numerical and experimental simulations consistently showed wind speed profiles with greater horizontal wind speeds closer to the ground than aloft. The tornado velocity pressure profile (K_{zTOr}) used has a uniform value of 1.0 from the ground up to a height of 200 ft, with a slightly smaller value at greater heights. In comparison, wind loads are based on an assumed boundary layer profile, where wind speeds are slower near the ground due to the effects of surface roughness.

Tornado Design Pressures. Atmospheric pressure change (APC) was found to have significant contributions to the tornado loads, particularly for large buildings with low permeability. The internal pressure coefficient was modified to also include the effects of APC. Since APC-related loads are not directionally dependent, the directionality factor was removed from the velocity pressure equation and added to the external pressure term (only) in the design pressure/load equations. The directionality factor K_d was modified through analysis of tornado load simulations on building MWFRS and components and cladding (C&C) systems. The resulting tornado directionality factor K_{dT} has values slightly less than the corresponding wind

K_d values, with the exception of roof zone 1' (in the field of the roof), which increased. External pressure and force coefficients for both the MWFRS and C&C remain unchanged, but a modifier (K_{VT}) was added to account for experimentally determined increases to uplift loads on roofs caused by updrafts in the core of the tornado.

Reliability. A reliability analysis was conducted to evaluate the tornado load provisions for the purpose of identifying appropriate return periods for the tornado hazard maps. This effort was conducted by a working group composed of members from both the ASCE 7-22 Load Combinations and Wind Load Subcommittees. Monte Carlo analyses (adapted from the ASCE 7-16 wind speed map return period analysis) were used, in which significant uncertainties for system demands and capacity were identified and quantified in the form of random variables with defined probability distributions. The results of this series of risk-informed analyses showed that the tornadic load criteria of Chapter 32 provided reasonable consistency with the reliability delivered by the existing criteria in Chapters 26 and 27 for MWFRS; therefore confirming that the 1,700- and 3,000-year return periods used for Risk Category III and IV wind hazard maps (respectively) in Chapter 26 were also suitable return periods to use for the tornado hazard maps.

Load Combinations. In both the Strength and Allowable Stress Design (ASD) load combinations that maximize wind load effects, the wind load term W is replaced by the term $(W \text{ or } W_T)$, where W_T is the tornado load. Tornado loads do not appear in combinations that maximize other loads where wind is an arbitrary point-in-time load.

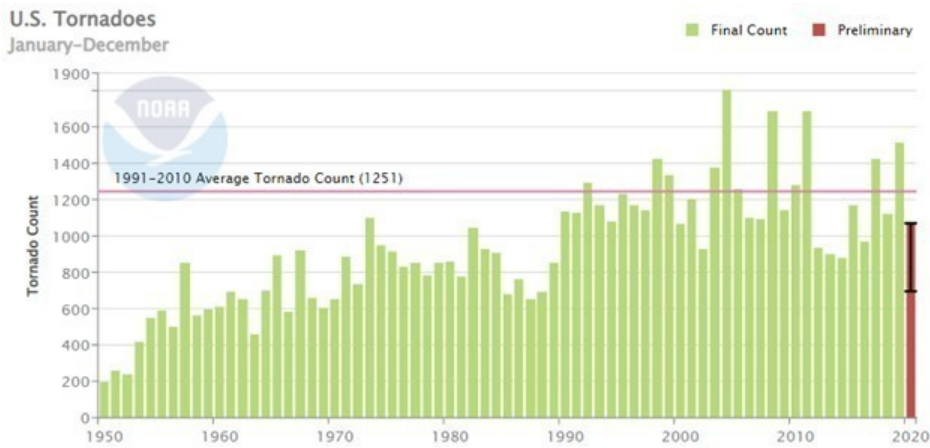


Figure 1. Number of reported tornadoes per year from 1950-2020 (NCEI 2022).

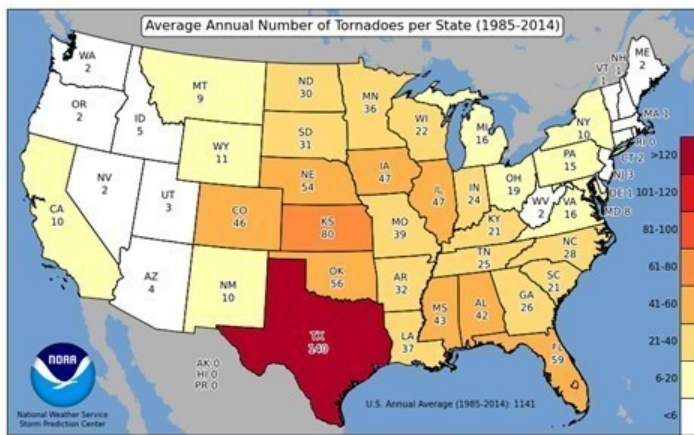


Figure 2. Average annual number of tornadoes per state (SPC 2022).

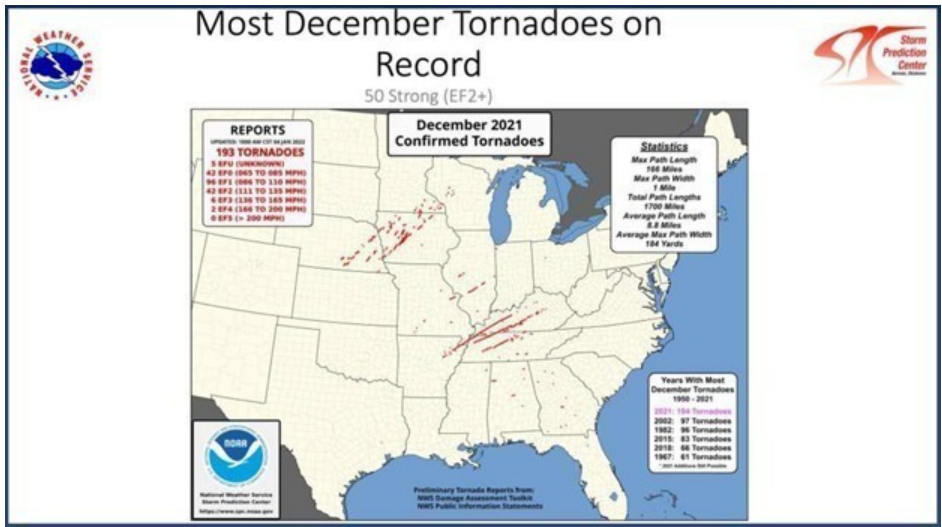


Figure 3. December 2021 produced a record 193 tornadoes across 17 states. (source: NOAA/NWS/Storm Prediction Center)

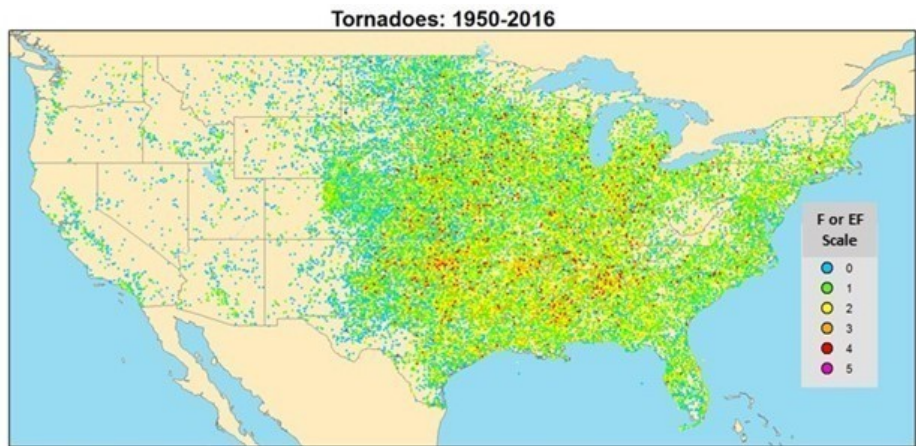


Figure 4. Map of tornado locations from 1950-2016 (source: NIST, using NOAA data).

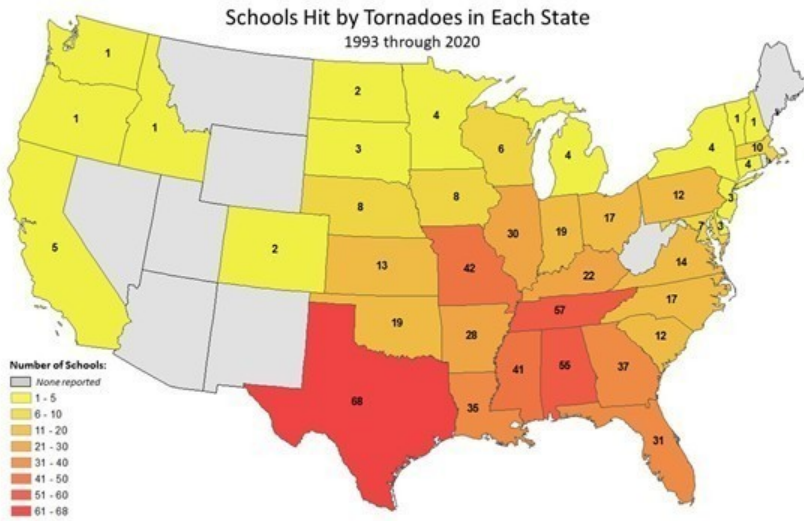


Figure 5. Lower bound for the number of schools struck by tornadoes, per state, for the 28-year period of 1993-2020 (source: NIST, using NOAA data).



Figure 6. EF-1 tornado in Covington, Georgia on New Year's Eve, 2021 (left); resulting damage to Veterans Memorial Middle School (right). (source: NWS)

References:

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NWS. 2022b. NWSChat - PUBLIC INFORMATION STATEMENT, NATIONAL WEATHER SERVICE PEACHTREE CITY GA, 258 PM EST SAT JAN 1. <https://nwschat.weather.gov/p.php?pid=202201011958-KFFC-NOUS42-PNSFFC>

Storm Prediction Center (SPC). 2022. Annual Averages: Tornadoes by State. National weather Service/ National Oceanic and Atmospheric Administration. <https://www.spc.noaa.gov/wcm/>

Cost Impact: The code change proposal will increase the cost of construction

This proposal may increase the cost of construction for Risk Category III and IV buildings and other structures located in the tornado-prone region where tornado loads govern the design.

The ASCE 7-22 tornado load provisions in Section 32.5.2 include provisions to help identify many of the situations where tornado loads will not control any aspects of the wind load design. If the tornado speed $V_T < 60$ mph, tornado loads will not control over wind loads, so design for tornado loads is not required. Additionally, if the tornado speed is less than a certain percentage of the basic (non-tornado) wind speed, V , tornado loads will not control. For structures located in wind Exposure Category B or C, design for tornado loads is not required where $V_T < 0.5V$ or $V_T < 0.6V$, respectively (in this context, Exposure B means that the structure is surrounded on all sides by urban, suburban or wooded terrain, otherwise it would be considered Exposure C). The exposure category does not change the tornado loads, while wind loads in Exposure B are less than in Exposure C. Therefore, a building located in Exposure B is more likely to have tornado loads control over wind loads compared to the same building in Exposure C.

Whether or not tornado loads will ultimately control any aspects of the wind load design for a particular structure is dependent on a large number of factors, including but not limited to:

1. tornado speed, which is a function of
 - o geographic location
 - o Risk Category
 - o effective plan area, which depends on footprint size and shape
2. basic wind speed, which is a function of
 - o geographic location
 - o Risk Category
3. wind exposure category
4. building shape
5. roof geometry
6. roof height
7. enclosure classification
8. designation as an essential facility or not

Maps were created to show where design for tornado loads is not required, based on the tornado speed criteria in the previous paragraph. Examples for a medium size Risk Category III facility and a very large Risk Category IV facility are shown in Figures 7 and 8, for both Exposures B and C. At locations where the tornado speed is greater than the specified percentage of the basic wind speed, design for tornado loads is required but may still not control. This is because the net pressure loading patterns on a building are different for tornadoic versus non-tornadoic winds, due to the differences in wind and wind-structure interaction characteristics which are reflected by factors 4 through 8 above.

For a medium-sized Risk Category III building, the tornado speeds are less than 60 mph across much of the tornado prone region (Figure 7). Tornado loads are required only in the areas shaded with the warm colors, which spans roughly between north Texas, central Minnesota, and the central Carolinas. In contrast, tornado loads are required across most of the tornado-prone region for very large Risk Category IV facilities, except New England and small areas of south Florida and south Louisiana for Exposure C (Figure 8). In both figures, the darker reds indicate areas that tornado loads are more likely to exceed wind loads. In general, tornado loads are more likely to control at least some element(s) of the wind load design for buildings and other structures that have one or more of the following characteristics:

- are located in the central or southeast US, except near the coast (where hurricanes can dominate the extreme wind climate),
- are Risk Category IV,
- have large effective plan areas,
- are designated as Essential Facilities,
- are located in Exposure B,
- have low mean roof heights, and
- are classified as enclosed buildings for purposes of determining internal pressures.

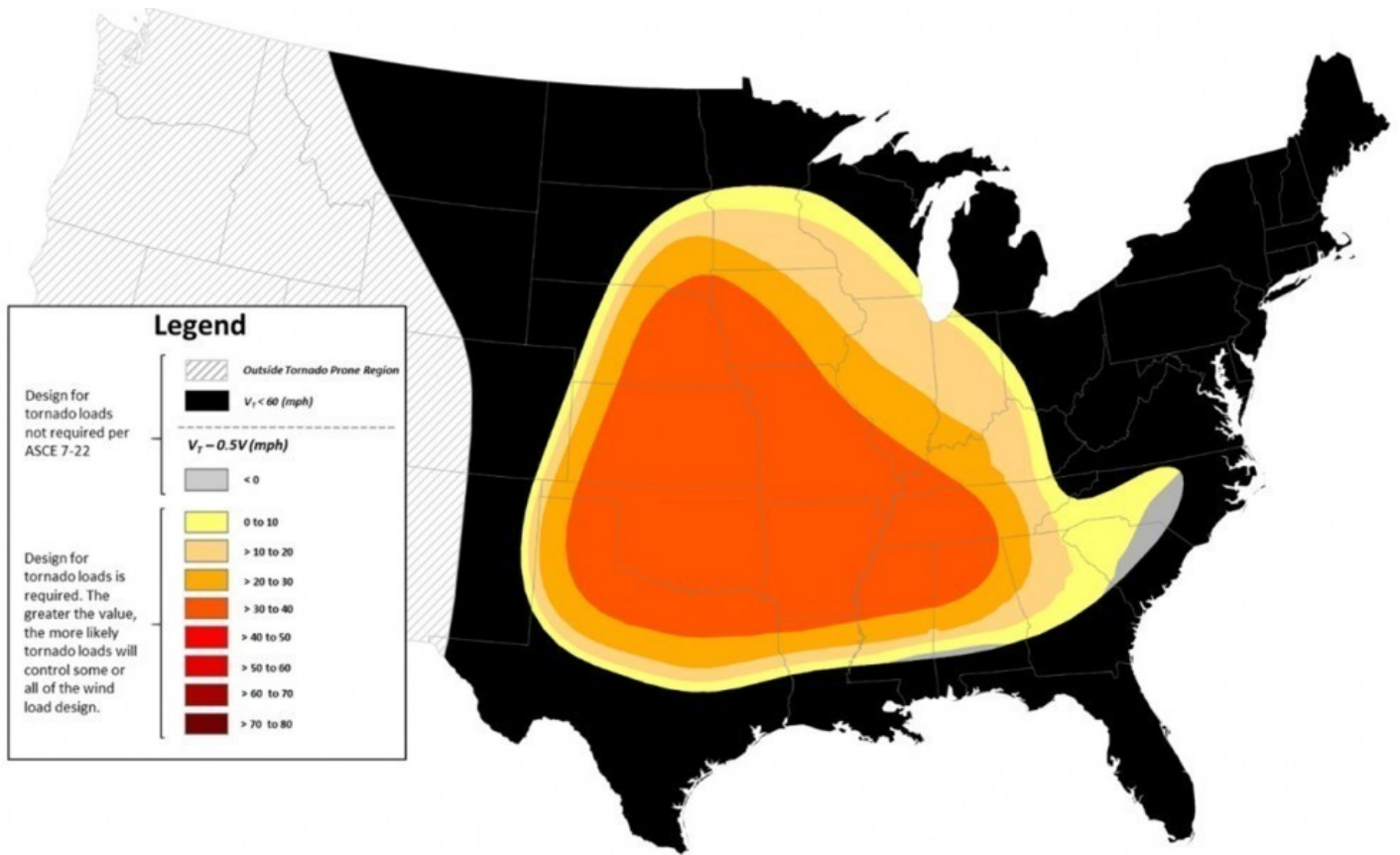
A case study was conducted to compare MWFRS and C&C pressures between ASCE 7-16 (non-tornado) and ASCE 7-22 tornado provisions in the Dallas / Fort Worth area of Texas, and also consider the cost impacts. The case study considered four building types, an elementary school, a high school, a fire station, and a large hospital facility. The schools were Risk Category III, while the fire station and hospital were Risk Category IV essential facilities. All were new construction (no additions or renovations).

The elementary school was assumed to have an effective plan area of 100,000 ft² while the high school was 500,000 ft². For the two-story schools, the basic wind speed $V = 112$ mph, while the tornado speeds for the elementary and high school were $V_T = 90$ and 102 mph, respectively. Even though the tornado speeds were less than the basic wind speeds, tornado loads exceeded wind loads for many elements of the design. The high school experienced greater increases in design pressures compared to the elementary school, given its greater tornado speed. The tornado loads were generally larger than the corresponding wind loads, with the most significant impacts occurring where the magnitude of MWFRS and C&C pressure coefficients are relatively small. Tornado suction pressures on the leeward wall and uplift pressures in the field of the roof were more than double the corresponding wind loads in some instances. This was primarily due to the increased tornado internal pressure coefficient and the new pressure coefficient adjustment factor for vertical winds, which increases the uplift on the roof. These surfaces have the smallest magnitude pressures to begin with, so increases of internal pressure and other coefficients have more relative effect. MWFRS loads on the windward walls of all schools also increased (again, due to internal pressures), but less than on the leeward walls. The net lateral loads on the buildings were not significantly impacted (internal pressure cancels out). MWFRS and C&C tornado pressures on roof edges and corners generally increased for the Exposure B cases, but were similar to or smaller than the corresponding wind design pressures when the schools were in Exposure C.

Although specific percentage changes to design pressures are dependent on many factors as discussed previously, the trend for the greatest relative impacts to occur on parts of the building or structure that have the smallest absolute values of wind loads holds true, as was the case for the fire station and hospital examples. The fire station and hospital were designed with effective plan areas of 15,000 ft² and 4 million ft² and heights of 20 ft and 80 ft (5-stories), respectively. The basic wind speed for Risk Category IV facilities in the DFW area is $V = 115$ mph. Tornado speeds for the fire station and hospital were $V_T = 97$ and 123 mph, respectively. The relative impacts on the fire station were generally somewhere between those for the elementary and high schools. The hospital, with its much greater tornado speed due to the large effective plan area, experienced greater relative pressure differences. For example, C&C tornado pressures (for effective wind area of 200 ft²) exceeded corresponding wind pressures across the four different flat roof pressure zones by 81 to 126% for Exposure B, and 39 to 73% for Exposure C. The tornado design pressures for the hospital were similar in magnitude to wind pressures for a comparable facility located in the hurricane-prone region along the Texas coast.

A study of the cost impacts for the schools showed that the structural cost increases were very modest. On the elementary school with a building cost of \$20M, the estimated cost increases were 0.24% and 0.14% for wind Exposure B and C, respectively. For the \$200M high school, the cost increases were 0.13% and 0.08% for Exposures B and C. The study did not include cladding and appurtenance costs. It should be noted that Dallas-Ft. Worth location of this case study is part of the most highly impacted area of the country (as seen in Figures 7 and 8 below), having a combination of comparatively high tornado speeds and low basic wind speeds. The increases in design pressures and costs diminish rapidly outside of the parts of the central and southeast US that experience the most frequent and intense tornadoes and have the greatest tornado speeds, roughly approximated as the area between north Texas, west Iowa, and north Alabama.

Therefore, while tornado load design could increase loads and pressures for Risk Category III and IV structures in the tornado prone area, the impacts on cost of construction resulting in increases will most likely be small when compared to the overall project costs.



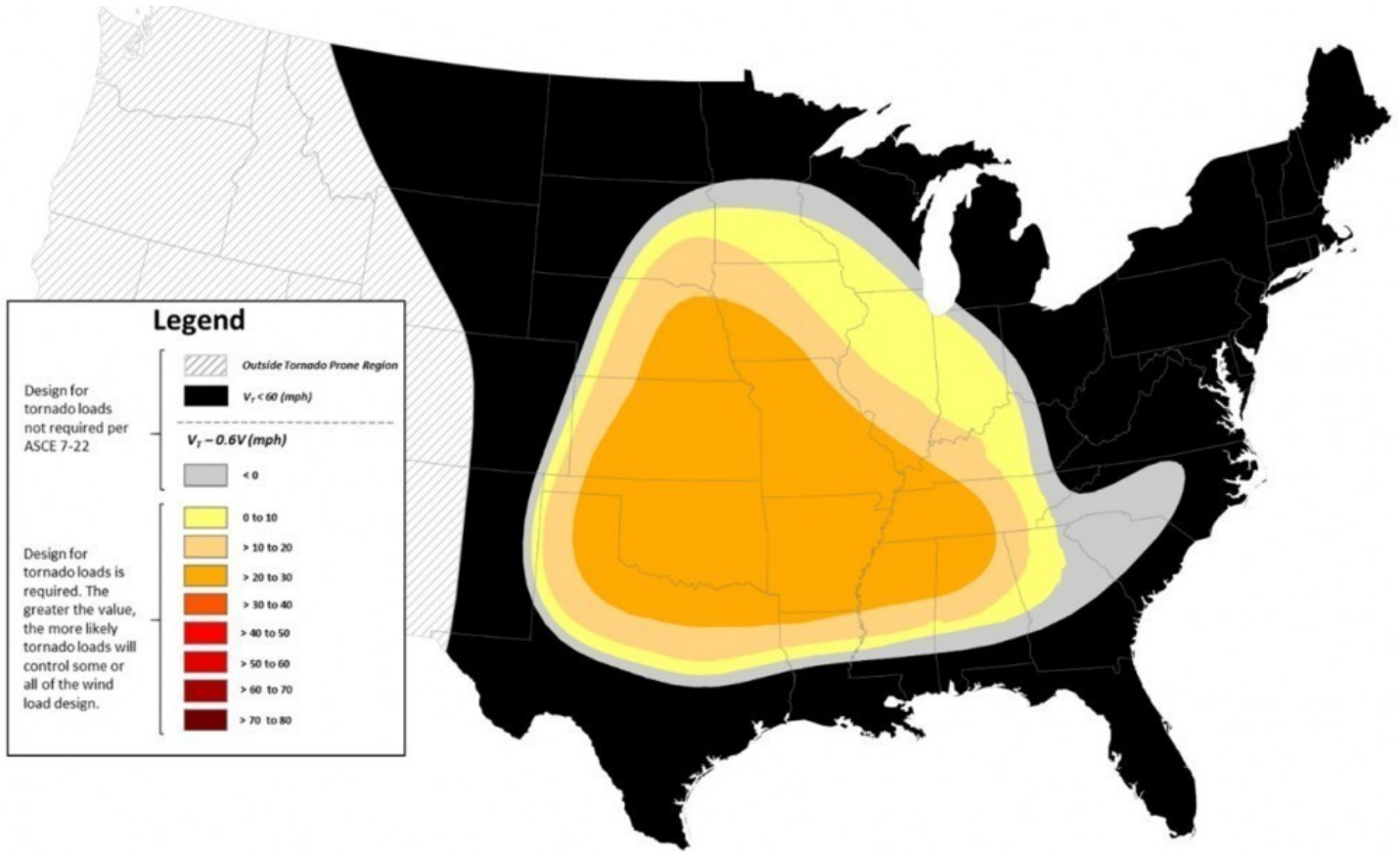
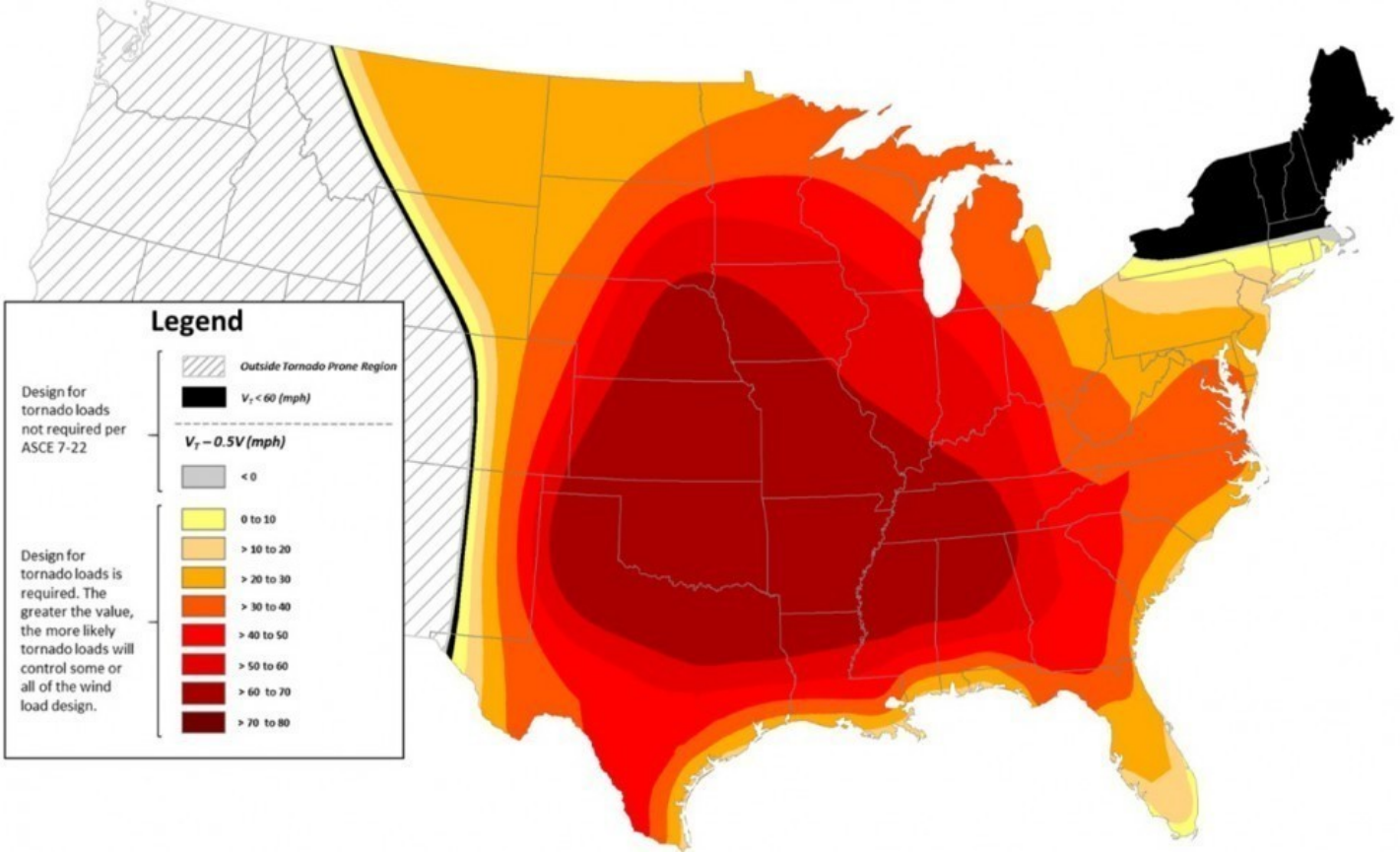




Figure 7. Locations where design for tornado loads is not required for a Risk Category III building or other structure having an effective plan area $A_e = 100,000 \text{ ft}^2$, located in Exposure B (top) and Exposure C (bottom).






Legend

Design for tornado loads not required per ASCE 7-22

-  Outside Tornado Prone Region
-  $V_t < 60$ (mph)

$V_t - 0.5V$ (mph)

-  < 0
-  0 to 10
-  > 10 to 20
-  > 20 to 30
-  > 30 to 40
-  > 40 to 50
-  > 50 to 60
-  > 60 to 70
-  > 70 to 80

Design for tornado loads is required. The greater the value, the more likely tornado loads will control some or all of the wind load design.

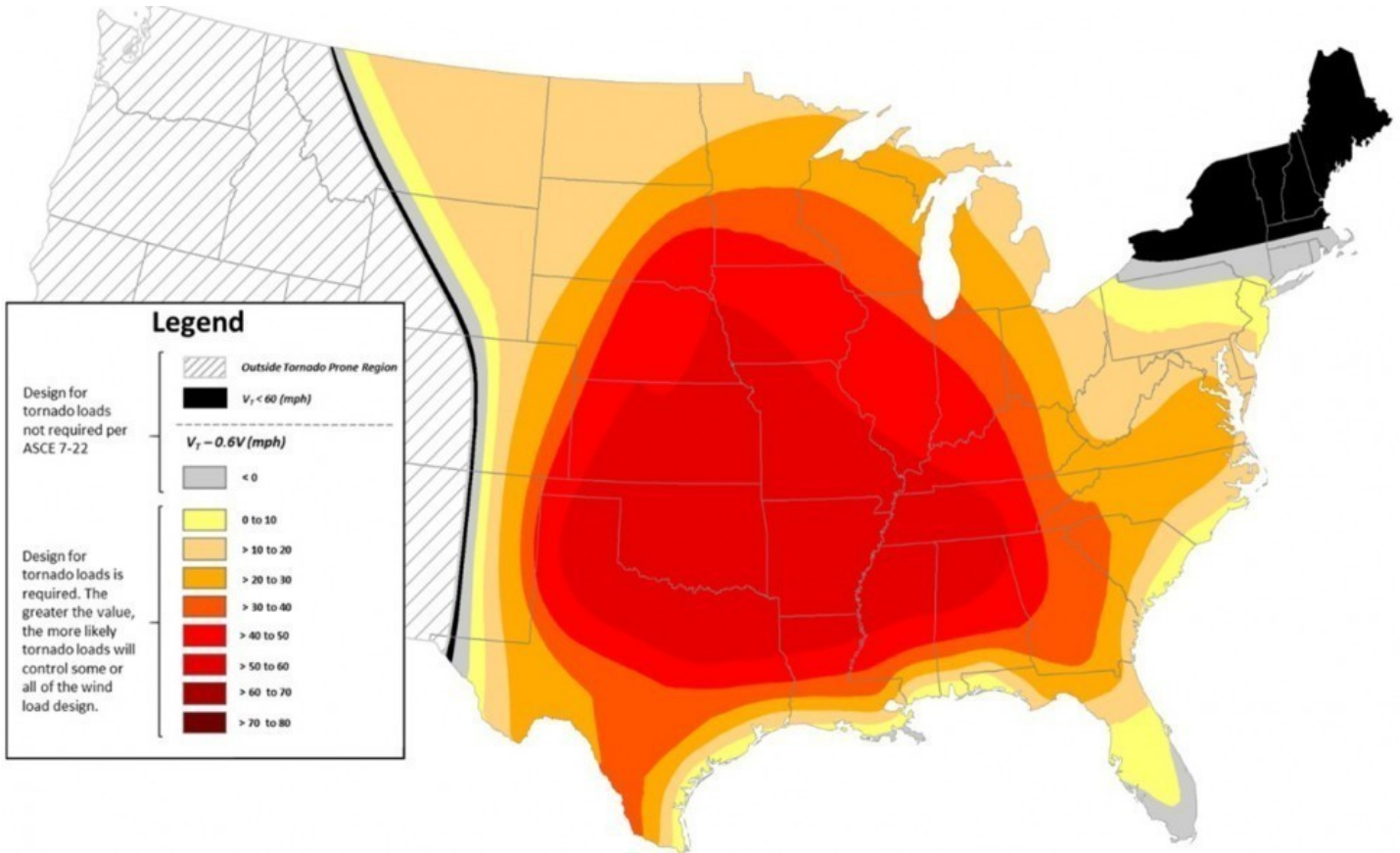


Figure 8. Locations where design for tornado loads is not required for a Risk Category IV building or other structure having an effective plan area $A_e = 1,000,000 \text{ ft}^2$, located in Exposure B (top) and Exposure C (bottom).

Staff Analysis: The proposal is referencing an updated version of an existing referenced standard. Therefore, the updated version is considered a new standard. A review of the standard proposed for inclusion in the code, ASCE/SEI 7-22 Minimum Design Loads and Associated Criteria for Buildings and Other Structures, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

B3302.4-21

IBC@: 3302.4 (New), 3302.5 (New), [F] 3312.1, [F] 3313.1, [F] 3313.2, [F] 3313.3, [F] 3313.3.1, [F] 3313.3.2, [F] 3313.3.3, [F] 3313.4, [F] 3313.5

Proponents: VFSB Codes and Standards Committee (amiliken@staffordcountyva.gov)

2021 International Building Code

Add new text as follows:

3302.4 Separations between construction areas. Separations used in Type I and Type II construction to separate construction areas from occupied portions of the building shall be constructed of materials that comply with one of the following:

1. Noncombustible materials.

2. Materials that exhibit a flame spread index not exceeding 25 when tested in accordance with ASTM E84 or UL 723.

3. Materials exhibiting a peak heat release rate not exceeding 300 kW/m² when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation on specimens at the thickness intended for use

3302.5 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction. Buildings of Types IV-A, IV-B and IV-C construction designed to be greater than six stories above grade plane shall comply with the following requirements during construction unless otherwise approved by the building code official:

1. Standpipes shall be provided in accordance with Section 3311.

2. A water supply for fire department operations, as approved by the fire code official and the fire chief.

3. Where building construction exceeds six stories above grade plane and noncombustible protection is required by Section 602.4 at least one layer of noncombustible protection shall be installed on all building elements on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

Exception: Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.

4. Where building construction exceeds six stories above grade plane, required exterior wall coverings shall be installed on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

Exception: Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.

Revise as follows:

[F] 3312.1 Completion before occupancy. In buildings where an *automatic sprinkler system* is required by this code, it shall be unlawful to occupy any portion of a building or structure until the *automatic sprinkler system* installation has been tested and *approved*, except as provided in Section ~~116.1.1~~.

[F] 3313.1 Where required. An *approved* water supply for fire protection, either temporary or permanent, shall be made available as soon as

combustible building materials arrive on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 3313.2 through 3313.5, the Virginia Statewide Fire Prevention Code.

Exception: The *fire code official* is authorized to reduce the fire flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire flow requirements is impractical.

Delete without substitution:

~~**[F] 3313.2 Combustible building materials.** When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.~~

~~**[F] 3313.3 Vertical construction of Types III, IV and V construction.** Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 3313.3.1 through 3313.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.~~

~~**[F] 3313.3.1 Fire separation up to 30 feet.** Where a building of Type III, IV or V construction has a *fire separation distance* of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an *existing structure* or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.~~

~~**[F] 3313.3.2 Fire separation of 30 feet up to 60 feet.** Where a building of Type III, IV or V construction has a *fire separation distance* of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an *existing structure* or otherwise can be built on, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.~~

~~**[F] 3313.3.3 Fire separation of 60 feet or greater.** Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.~~

~~**[F] 3313.4 Vertical construction, Types I and II construction.** If combustible building materials are delivered to the construction site, water supply in accordance with Section 3313.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.~~

~~**[F] 3313.5 Standpipe supply.** Regardless of the presence of combustible building materials, the construction type or the *fire separation distance*, where a standpipe is required in accordance with Section 3313, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.~~

Reason Statement: Clean up of Chapter 33 Fire Safety During Construction to relocate construction provisions from the SFPC and correlate better with the SFPC and VEBC. Sections 3309.3 and 3309.4 are relocating the deleted construction sections from the SFPC. Section 3312.1 corrects the reference to 116.1.1 for temporary occupancy. Section 3313.1 is revised with 2021 language and references the SFPC for fire flow requirements. It also includes deleting sections 3313.2 through 3313.5 which are to be in the SFPC.

Resiliency Impact Statement: This proposal will increase Resiliency

By improving Chapter 33 of the VCC, the resiliency of communities is increased by protecting them from the hazards associated with poor fire safety practices during construction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

No cost impact.

EB1209.1-21

VEBC: 1209.1

Proponents: VFSB Codes and Standards Committee (amiliken@staffordcountyva.gov)

2018 Virginia Existing Building Code

Revise as follows:

1209.1 When required. An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material arrives on the ~~site-site~~, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with the Virginia Statewide Fire Prevention Code.

Reason Statement: Clean up of Section 1209.1 to provide 2021 language and reference the SFPC for fire flow and associated details. It also correlates better with the VCC and SFPC.

Resiliency Impact Statement: This proposal will increase Resiliency

By improving the fire safety provisions of the VEBC, the resiliency of communities is increased by protecting them from the hazards associated with poor fire safety practices during construction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

No cost impact.

EC-C401.2-21

IECC®: SECTION 202 (New), C401.2, C404.8.1, C405.5.3, TABLE C406.1(1), TABLE C406.1(2), TABLE C406.1(3), TABLE C406.1(4), TABLE C406.1(5), C406.7.3

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

ALL-ELECTRIC BUILDING. *A building that contains no combustion equipment, or plumbing for combustion equipment, installed within the building, or building site.*

APPLIANCE. *A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.*

COMBUSTION EQUIPMENT. *Any equipment or appliance used for space heating, service water heating, cooking, clothes drying, or lighting that uses fuel gas or fuel oil.*

COMMERCIAL COOKING APPLIANCE. *Appliances used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries, and similar appliances. For the purpose of this definition, a food service establishment shall include any building or a portion thereof used for the preparation and serving of food.*

EQUIPMENT. *Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.*

Revise as follows:

C401.2 Application. Commercial buildings shall be *all-electric buildings* and shall comply with Section C401.2.1 or C401.2.2.

C404.8.1 Heaters. The electric power to all heaters shall be controlled by an on-off switch that is an integral part of the heater, mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater in a location with *ready access*. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be ~~equipped with continuously burning ignition pilots. permitted.~~

C405.5.3 Gas lighting. Gas-fired lighting appliances shall not be ~~permitted. equipped with continuously burning pilot ignition systems. systems.~~

TABLE C406.1(1) ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP B OCCUPANCIES

SECTION	CLIMATE ZONE																
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406.2.2: 5% cooling efficiency improvement	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	1	1	2	2	NA	1
C406.2.4: 10% cooling efficiency improvement	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3: Reduced lighting power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4: Enhanced digital lighting controls	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5: On-site renewable energy	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6: Dedicated outdoor air	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.2: Recovered or renewable water heating	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: Efficient fossil fuel water heater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.4: Heat pumpwater heater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: Enhanced envelope performance	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced air infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6
C406.10: Energy monitoring	4	4	4	4	3	3	3	3	3	3	2	3	2	2	2	2	2
C406.11: Fault detection and diagnostics system	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

NA = Not Applicable.

TABLE C406.1(2) ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP R AND I OCCUPANCIES

SECTION	CLIMATE ZONE																
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406.2.2: 5% cooling efficiency improvement	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406.2.4: 10% cooling efficiency improvement	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406.3: Reduced lighting power	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
C406.4: Enhanced digital lighting controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.5: On-site renewable energy	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406.6: Dedicated outdoor air system	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406.7.2: Recovered or renewable water heating	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.3: Efficient fossil fuel water heater	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.4: Heat pump water heater	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: Enhanced envelope performance	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406.9: Reduced air infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3
C406.10: Energy monitoring	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.11: Fault detection and diagnostics system	1	1	1	1	1	1	NA	1	1	NA	1	1	NA	1	1	1	1

NA = Not Applicable.

TABLE C406.1(3) ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP E OCCUPANCIES

SECTION	CLIMATE ZONE																
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406.2.2: 5% cooling efficiency improvement	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406.2.4: 10% cooling efficiency improvement	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406.3: Reduced lighting power	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406.4: Enhanced digital lighting controls	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
C406.5: On-site renewable energy	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406.6: Dedicated outdoor air system	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.2: Recovered or renewable water heating ^a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.7.3: Efficient fossil fuel water heater^a	NA	4	4	4	4	4	4	2	2	3	2	3	2	3	3	3	5
C406.7.4: Heat pump water heater ^a	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1	1	1	1
C406.8: Enhanced envelope performance	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406.9: Reduced air infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3
C406.10: Energy monitoring	3	3	3	3	3	3	3	3	3	2	2	3	2	2	2	2	2
C406.11: Fault detection and diagnostics system	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2

NA = Not Applicable.

a. For schools with showers or full-service kitchens.

TABLE C406.1(4) ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP M OCCUPANCIES

SECTION	CLIMATE ZONE																
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406.2.2: 5% cooling efficiency improvement	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406.2.4: 10% cooling efficiency improvement	9	12	9	8	6	6	3	4	4		2	3	NA	2	2	2	1
C406.3: Reduced lighting power	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406.4: Enhanced digital lighting controls	3	3	4	3	4	3	4	4	4	3	3	3	3	4	4	3	3
C406.5: On-site renewable energy	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406.6: Dedicated outdoor air system	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406.7.2: Recovered or renewable water heating	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: Efficient fossil fuel water heater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.4: Heat pump water heater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: Enhanced envelope performance	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406.9: Reduced air infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3
C406.10: Energy monitoring	4	5	5	5	5	4	4	4	4	3	3	4	3	4	4	4	3
C406.11: Fault detection and diagnostics system	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2

NA = Not Applicable.

TABLE C406.1(5) ADDITIONAL ENERGY EFFICIENCY CREDITS FOR OTHER^a OCCUPANCIES

SECTION	CLIMATE ZONE																
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406.2.2: 5% cooling efficiency improvement	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406.2.4: 10% cooling efficiency improvement	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406.3: Reduced lighting power	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406.4: Enhanced digital lighting controls	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: On-site renewable energy	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406.6: Dedicated outdoor air system	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406.7.2: Recovered or renewable water heating ^b	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.3: Efficient fossil fuel water heater ^b	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.4: Heat pump water heater ^b	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: Enhanced envelope performance	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406.9: Reduced air infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4
C406.10: Energy monitoring	3	3	3	3	3	3	3	3	3	3	2	3	2	2	2	3	2
C406.11: Fault detection and diagnostics system	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

NA = Not Applicable.

- a. Other occupancy groups include all groups except Groups B, E, I, M and R.
- b. For occupancy groups listed in Section C406.7.1.

Delete without substitution:

~~**C406.7.3 Efficient fossil fuel water heater.** The combined input capacity weighted average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95 percent Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with Section C404.2.1.~~

Reason Statement: In order to meet the state’s 2045 carbon neutrality goal, Virginia must not only reduce energy use through energy efficiency and move to utility scale and on-site renewable energy, but also begin to transition away from using combustion equipment in buildings that runs on fossil fuels to electric equipment.

In 2020, combustion equipment in commercial and residential buildings accounted for 36% of the United States energy-related greenhouse gas emissions. To meet Virginia’s goal, it is crucial that new buildings built today are all-electric so that emissions from these buildings are not “locked-in” by gas-dependent building infrastructure. Reduced carbon emissions was also recently cited as a priority of energy code development by the ICC in their Leading the Way to Energy Efficiency: A Path Forward on Energy and Sustainability to Confront a Changing Climate in 2021.

This proposed code amendment seeks to address the carbon impact of commercial buildings by requiring all new commercial buildings to be all-electric in Section C401.2. The amendment removes vestigial language that relates to fossil fuel systems related to pool heaters and lighting and clarifies that low-energy buildings must also be all-electric. To clarify the definition of all-electric and combustion equipment, the definition for appliance, equipment, fuel gas, and fuel oil are mirrored from 2021 IMC to be useful in defining combustion equipment.

Requiring all-electric construction as described above will result in new construction that is less expensive to construct than a building constructed with gas appliances and in the long term will result in fewer retrofit costs for building owners to meet future policy goals to eliminate all carbon emissions in the U.S. by 2050. All-electric construction will also result in lower utility costs if high efficiency heat pump technology is used. An Ecotope study of the 2017 Oregon Residential code found that homes heated by electric heat pumps use 40 percent less energy than homes heated with gas (including water heating). Even accounting for reduced efficiency in extreme cold weather, according to a study by RMI, modern air source heat pumps are more than twice as efficient as gas furnaces and can save families up to 9 percent on their utility bills in Climate Zone 6. This is one reason why the U.S. EPA just announced that standards for the most efficient appliances in 2022 certified under the ENERGY STAR program will be all-electric.

All-electric buildings are also healthier. Gas appliances release harmful pollutants like nitrogen dioxide (NO2) and carbon monoxide (CO) either indoors because of gas stoves or outdoors because of space-heating and water heating equipment. A recent study from the Harvard Chang School of Public Health and RMI shows that in 2017, air pollution from burning fuels in buildings led to an estimated 48,000 to 64,000 early deaths and \$615 billion in health impact costs. These emissions can particularly affect children. In a meta-analysis analyzing the connections between gas stoves

and childhood asthma, children in homes with gas stoves were 42% more likely to experience asthma symptoms, and 32% more likely to be diagnosed with asthma.

Therefore, constructing all-electric buildings is critical to reducing air pollution, protecting public health, reducing utility and construction costs, and meeting climate goals. NBI is submitting this amendment along with amendments that address on-site renewables, electric vehicles, and grid integration techniques. These proposed changes to the 2021 IECC, working together, will put the U.S. on the path to a decarbonized, resilient, and healthier future.

Resiliency Impact Statement: This proposal will increase Resiliency

As the grid becomes increasingly cleaner, all electric buildings will become less carbon intense as they age, unlike buildings with fossil fuel combustion, lessening their impact on climate change. Although these buildings will require more total electricity from the grid than their fossil fuel burning counterparts, they will be able to operate entirely on clean renewable energy.

All-electric buildings additionally support better indoor air quality. Better indoor air quality is directly linked to better health of occupants, including reduction of respiratory and chronic illnesses. The reductions of these types of illnesses increase overall resilience of individuals within our communities, making them less susceptible to the impacts of extreme heat and cold, reducing medical bills, and improving overall quality of life.

Finally, these buildings will also be less dependent on the geopolitics of the fossil fuel market, leveling out energy costs during periods of disruption.

Cost Impact: The code change proposal will decrease the cost of construction

All-electric commercial buildings are less expensive to build than mixed fuel buildings because electric appliances and equipment are typically less expensive than combustion equipment and appliances. In addition, developers avoid the cost of installing natural-gas lines and meters. Recent analysis by NBI and partners utilizing data from RS Means indicates that an all-electric 53,000 s.f. office building with a central heat pump water heater and minimum code compliant air source heat pump costs \$0.09/s.f. less to build than a mixed-fuel office building of the same size. Additional analyses from a recent CASE study indicate that all-electric high-rise multifamily buildings are also less expensive to build and operate than mixed-fuel buildings. HVAC costs, for example, are on the order of \$2,504 to \$7,131 lower per dwelling unit depending on the HVAC system installed. Installing electric space heating and water heating equipment instead of natural gas equipment in the majority of California's climate zones also yielded a positive benefit to cost ratio over the 15- year analysis period despite California's high electricity rates.

Another study by ACEEE indicates that assuming energy-efficient construction, electrification incentives, and carbon pricing, space heating in 60% of the existing commercial building stock in the U.S. can be cost effectively retrofitted to electric space-heating with a simple payback of less than 10 years. The percentage of spaces where space-heating is cost effective across the country in new construction is likely higher because no retrofit costs are incurred in new construction and because new construction is already mandated to be energy efficient.

Finally, ensuring commercial buildings are all-electric now will guarantee that those buildings will not have to be retrofitted to be all-electric in the future to meet the nation's goal to be net-zero carbon emissions by 2050.

EC-C403.3-21

IECC®: C403.3, C403.3.5 (New), C403.7.4, C403.7.4.3 (New), C406.1

Proponents: Ben Rabe (ben@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org); Diana Burk (diana@newbuildings.org)

2021 International Energy Conservation Code

Revise as follows:

C403.3 Heating and cooling equipment efficiencies Equipment selection. Heating and cooling equipment installed in mechanical systems shall be sized in accordance with Section C403.3.1 and shall be not less efficient in the use of energy than as specified in Section C403.3.2.

Add new text as follows:

C403.3.5 Dedicated outdoor air systems (DOAS).

Outdoor air shall be provided to each occupied space by a dedicated outdoor air system (DOAS), as required by Table C403.3.5, which delivers 100 percent outdoor air without requiring operation of the heating and cooling system fans for ventilation air delivery, as required by Table C403.3.5. For DOAS having a total fan system motor nameplate hp less than 5 hp, total combined fan power shall not exceed 1 W/cfm of outdoor air. Total fan power limits of Section C403.8.1 shall apply to each outdoor air unit of the DOAS and shall not include the fan power associated with the zonal heating and cooling equipment.

Exceptions:

1. Use groups listed as exempted in Table C403.3.5
1. Occupied spaces that are solely ventilated by a natural ventilation system in accordance with Section 402 of the International Mechanical Code;
1. Buildings where the cooling and heating equipment exceeds the minimum efficiency requirements listed in the tables in Section C403.3.2 by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the rating requirement, including IEER, SEER and IPLV as applicable. This exception shall not be used as a substitution for the more efficient HVAC equipment credit option per C406.2.

Table C403.3.5

Occupancy Classifications Requiring DOAS

<u>OCCUPANCY CLASSIFICATIONS</u>	<u>COVERED USE GROUPS</u>	<u>EXEMPTED USE GROUPS</u>
<u>A-1</u>	<u>All occupancies</u>	<u>Television and radio studios</u>
<u>A-2</u>	<u>Casinos (gaming area)</u>	<u>All other use groups</u>
<u>A-3</u>	<u>Lecture halls, community halls, exhibition halls, gymnasiums, courtrooms, libraries, places of religious worship</u>	<u>All other use groups</u>
<u>A-4, A-5</u>		<u>All use groups</u>
<u>B</u>	<u>All use groups not specifically exempted</u>	<u>Food processing establishments including commercial kitchens, restaurants, cafeterias; laboratories for testing and research; data processing facilities and telephone exchanges; air traffic control towers; animal hospitals, kennels, pounds; ambulatory care facilities.</u>
<u>F, H, I, R, S, U</u>		<u>All use groups</u>
<u>E, M</u>	<u>All use groups</u>	

C403.3.5.1 Heating/cooling system fan controls. Heating and cooling equipment fans, heating and cooling circulation pumps, and terminal unit fans shall cycle off and terminal unit primary cooling air shall be shut off when there is no call for heating or cooling in the zone.

Exception:

Fans used for heating and cooling using less than 0.12 watts per cfm may operate when space temperatures are within the set point dead band to provide destratification and air mixing in the space.

C403.3.5.2 Decoupled DOAS supply air. The DOAS supply air shall be delivered directly to the occupied space or downstream of the terminal heating and/or cooling units.

Exceptions:

1. Active chilled beam systems.
1. Sensible only cooling terminal units with pressure independent variable airflow regulating devices limiting the DOAS supply air to the greater of latent load or minimum ventilation requirements.
1. Terminal heating and/or cooling units that comply with the low fan power allowance requirements in the exception of Section C403.3.5.1.

Revise as follows:

C403.7.4 Energy recovery systems. Energy recovery ventilation systems shall be provided as specified in Section C403.7.4.3 and either Section C403.7.4.1 or C403.7.4.2, as applicable. ~~in~~

Add new text as follows:

C403.7.4.3 Spaces with Dedicated Outdoor Air Systems (DOAS).

Dedicated outdoor air systems (DOAS) shall include energy recovery ventilation in all cases and shall be in accordance with either Section C403.7.4.1 or C403.7.4.2, as applicable.

Exception: Systems installed for the sole purpose of providing makeup air for systems exhausting toxic, flammable, paint, or corrosive fumes or dust, dryer exhaust, or commercial kitchen hoods used for collecting and removing grease vapors and smoke.

Revise as follows:

C406.1 Additional energy efficiency credit requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of Section C406. Where a building contains multiple-use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

~~Provision~~

1.

2.

3.

4.

5.

Where not required by Section 403.3.5, the ~~p~~ provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C

6.

7.

8.

9.

10.

11.

Reason Statement: The majority of commercial HVAC systems are based around a central air handling delivery system. This system typically provides heating, cooling and ventilation air from a single source. Since cooling is typically the largest instantaneous load, the fans must be sized large enough to deliver enough air to meet the peak cooling requirements. When the ventilation is integrated, these large fans must operate during all occupied hours to deliver ventilation effectively to the space. This leads to very high fan energy use. With ventilation separated from the heating and cooling delivery, the large heating/cooling fans can be shut off unless there is a call for heating or cooling and the much smaller ventilation-only fans can operate to deliver fresh air to the space. Furthermore, when the ventilation air is delivered using either Energy Recovery Ventilation (ERV) the heating energy requirements associated with tempering the ventilation air are significantly reduced or eliminated. Compliance with this proposed code amendments requires the following in buildings where the cooling or heating system is not 10 percent more efficient than code requirements.

a. 100% ventilation air delivered directly to each zone separate from the heating/cooling system.

b. Ventilation air delivered using an ERV

c. Run heating and cooling equipment (fans and pumps) only when there is a call for conditioning in the zone.

Note that designs based around a DOAS is not new and it has long been established that this design direction leads to more energy efficient buildings. The General Services Administration required DOAS as the baseline design for all new GSA buildings unless otherwise directed by design

programming in 1998. The specifications require perimeter and interior systems have 100 percent outside air ventilation systems which are completely independent of any other air distribution system. Enthalpy heat recovery must be included if the outside air required or equipment capacity exceeds a stated amount.

This proposed code change is similar to the requirements currently adopted in the Washington State Energy Code which requires buildings of only certain occupancy types to have a DOAS system. A DOAS would be required in buildings whose occupancy is intended for Mercantile (Group M), and Educational (Group E). A DOAS would also be required in most Business's (Group B) except those exempted, certain Assembly occupancies (Group A) for performing arts or motion pictures (except for television and radio studios), casinos, and lecture halls, community halls, exhibition halls, gymnasiums, courtrooms, libraries, and places of religious worship. A DOAS would not be required in buildings where the cooling or heating system is 10 percent more efficient than code requirements.

A DOAS would also not be required in the building for occupancies for Residential (Group R), Factory and Industrial (Group F), High Hazard (Group H), Institutional (Group I), Storage (Group S), and Utility and Miscellaneous (Group U).

Resiliency Impact Statement: This proposal will increase Resiliency

Resiliency is an essential component of adapting to the effects of climate change. As we see increasing number of severe weather events, the electric grid's ability to withstand these events will become increasingly important. Dedicated Outdoor Air Systems will increase overall energy efficiency of space conditioning, therefore reducing strain on the electric grid would. As peak demand typically coincides with periods of high usage in the buildings sector, this would increase the resiliency of the grid.

Cost Impact: The code change proposal will increase the cost of construction

On average the incremental cost of adding a DOAS for several building prototypes (small, medium and large office, retail, and schools) was found to be \$880 per thousand square foot. The increased cost of requiring DOAS systems is more than offset by operating cost savings. When compared to a code-minimum system upgrade, very high efficiency DOAS can reduce commercial building energy use by an average of 9% to 17% depending on the type of DOAS system used in Climate Zone 4A. In California, installing a DOAS was found to save on average \$4-\$5 in operating costs for every additional dollar spent to install a DOAS in a building. Buildings with DOAS systems not only save energy but also exhibit improved indoor air quality which is especially important in businesses and schools.

EC-C403.4.1.6-21

IECC®: SECTION 202 (New), C403.4.1.6 (New)

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a demand response signal.

C403.4.1.6 Demand responsive controls. All thermostatic controls shall be provided with *demand responsive controls* capable of the following:

1. Automatically increasing the zone operating cooling set point by a minimum of 4°F (2.2°C)
2. Automatically decreasing the zone operating heating set point by a minimum of 4°F (2.2°C)
3. Automatically decreasing the zone operating cooling set point by a minimum of 2°F (1.1°C)
4. Automatically increasing the zone operation heating set point by a minimum of 2°F (1.1°C)
5. Both ramp-up and ramp-down logic to prevent the building peak demand from exceeding that expected without the DR implementation.

The thermostatic controls shall be capable of performing all other functions provided by the control when the *demand responsive controls* are not available. Systems with direct digital control of individual zones reporting to a central control panel shall be capable of remotely complying.

Exception: Health care and assisted living facilities.

Reason Statement: This proposal requires that thermostats in commercial buildings have demand control functionality that can be used to adjust thermostat set-points. Since this requirement is part of the construction code, it will not require buildings to participate in any demand response programs. But it will ensure that buildings are capable of participating, so that Virginia buildings will be able to help integrate building loads with available production.

Grid flexibility is one of the foundations of achieving meaningful decarbonization of building energy as it is an essential element of decarbonizing the electrical grid. Carbon free energy sources like solar and wind have varying production over the course of the day and the year. Demand responsive controls that can respond to demand response signals enable buildings to shape their loads to better align with available energy production. This could come in the form of curtailing energy use when demand is high or utilizing excess production for building tasks like pre-conditioning spaces or service hot water when demand is lower.

The ability to adjust by 4 degrees was chosen based on demand flexibility requirements in California's energy code Title 24 Part 6. This will align the requirements with the biggest American market – which is also a neighboring market – for demand responsive thermostats. The proposal includes an exemption for thermostats serving health care and assisted living facilities as these are occupancies where climate control can be related to health care.

Resiliency Impact Statement: This proposal will increase Resiliency

Resiliency is an essential component of adapting to the effects of climate change. As we see increasing number of severe weather events, the electric grid's ability to withstand these events will become increasingly important. Demand controlled thermostats will help integrate building loads with available production, lowering energy demand. Therefore, this proposal increase resiliency by reducing overall demand on the grid.

Cost Impact: The code change proposal will increase the cost of construction

Demand responsive functionality will present a cost-saving opportunity for buildings in the future. More and more utilities are moving beyond voluntary programs and are expanding use of time-of-use rates for electricity as a tool for shaping demand. Installing demand-responsive thermostats now will allow building tenants and owners to better control their utility costs.

Demand responsive functionality has been required in Title24 since the 2013 edition and was found cost effective in CA. In the 8 years since, equipment prices have decreased (less than \$60 for a basic DR thermostat⁷ compared to just under \$30 for a basic 7-day programmable thermostat⁸) and WA peak prices have increased.

EC-C403.15-21

IECC®: SECTION 202 (New), C403.15 (New), DOE Chapter 06

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

DESSICANT DEHUMIDIFICATION SYSTEM. A mechanical dehumidification technology that uses a solid or liquid material to remove moisture from the air.

INTEGRATED HVAC SYSTEM. An HVAC system designed to handle both sensible and latent heat removal. Integrated HVAC systems may include, but are not limited to HVAC systems with a sensible heat ratio of 0.65 or less and the capability of providing cooling, dedicated outdoor air systems, single package air conditioners with at least one refrigerant circuit providing hot gas reheat, and dehumidifiers modified to allow external heat rejection.

DEHUMIDIFIER. A self-contained, electrically operated, and mechanically encased product with the sole purpose of dehumidifying the space consisting of 1) a refrigerated surface (evaporator) that condenses moisture from the atmosphere, 2) a refrigerating system, including an electric motor, 3) an air-circulating fan, and 4) a means for collecting or disposing of the condensate. A dehumidifier does not include a portable air conditioner, room air conditioner, or packaged terminal air conditioner.

C403.15 Dehumidification in spaces for plant growth and maintenance. Equipment that dehumidifies building spaces used for plant growth and maintenance shall comply with one of the following:

1. Dehumidifiers regulated under federal law in accordance with DOE 10 CFR 430 and tested in accordance with the test procedure listed in DOE 10 CFR 430 and DOE 10 CFR 430, Subpart B, Appendix X or X1 as applicable.

2. Integrated HVAC system with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat;

3. Chilled water system with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat; or

4. Solid or liquid desiccant dehumidification system for system designs that require dewpoint of 50° F or less.

Revise as follows:

DOE

US Department of Energy
c/o Superintendent of Documents 1000 Independence Avenue SW
Washington, DC 20585

10 CFR, Part 430—2015

Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirement for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances; Final Rule
Table C403.15

Reason Statement: Indoor agriculture energy usage is projected to grow significantly nationwide in this decade, driven in large part by state

legalization of medical and recreational marijuana across the country. In 2017, a total of 20 million square feet of building space was dedicated to growing crops indoors. Since Virginia legalized recreational marijuana on July 1, 2021, this industry will also experience sharp growth in Virginia. Energy use by HVAC systems in indoor horticulture facilities can account for 30 to 65% of energy use - primarily because these systems must maintain specific humidity and temperature levels to promote plant growth. Section 403 already requires HVAC systems meet a certain efficiency threshold but does not address the efficiency of dehumidification systems. The proposed language provides projects with a range of efficient dehumidification strategies. Indoor grow facilities can install dehumidifiers that meet federal minimum efficiency requirements. The proposal also provides options for solid or liquid desiccant dehumidification systems, for utilizing recovered energy in integrated HVAC systems, and for chilled water systems that can meet dehumidification reheat needs.

The incremental cost of installing more efficient dehumidification systems is around \$8.11 per square foot of canopy. This measure results in significant energy savings of between 212 to 255 TDV kBtu/yr per square foot of canopy in Climate Zones 2-4. Every dollar spent to install more efficient equipment resulted in between \$2.33 and \$2.80 in operating and maintenance cost savings over the life of the system.

This proposal is based largely on the requirements listed in Section 120.6(h)1 of Title 24-2022 and is similar to requirements adopted in Denver, CO and being considered for adoption in Washington State, Michigan, and Illinois.

Resiliency Impact Statement: This proposal will increase Resiliency

Resiliency is an essential component of adapting to the effects of climate change. As we see increasing number of severe weather events, the electric grid's ability to withstand these events will become increasingly important. Indoor agricultural facilities place a huge demand on the local energy supply, rivaling that of data centers. The dehumidification proposal will significantly reduce energy demand of these facilities and therefore increase resiliency by reducing overall demand on the local grid where facilities are being added.

Cost Impact:

The incremental cost of installing more efficient dehumidification systems is around \$8.11 per square foot of canopy. This measure results in significant energy savings of between 212 to 255 TDV kBtu/yr per square foot of canopy in Climate Zones 2-4. Every dollar spent to install more efficient equipment resulted in between \$2.33 and \$2.80 in operating and maintenance cost savings over the life of the system.

References:

Final CASE Report: Controlled Environment Horticulture, California Statewide Codes and Standards Enhancement (CASE) Program, Oct. 2020, <https://title24stakeholders.com/wp-content/uploads/2020/10/2022-T24-NR-CEH-Final-CASE-Report.pdf>.

EC-C404.11-21

IECC®: SECTION 202 (New), C404.11 (New), 6 ASME, 6 ANSI

Proponents: Ben Rabe (ben@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a demand response signal.

C404.11 Demand Responsive water heating. Electric storage water heaters with a rated water storage volume between 40 and 120 gallons and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls that comply with Table C404.11

Exceptions:

1. Water heaters that provide a hot water delivery temperature of 180°F (82°C) or greater
2. Water heaters that comply with Section IV, Part HLW or Section X of the ASME Boiler and Pressure Vessel Code
3. Water heaters that use 3-phase electric power

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Table C404.11

<u>Equipment Type</u>	<u>Rated Water Storage Volume</u>	<u>Controls</u>	
		<u>Before 7/1/2025</u>	<u>As of 7/1/2025</u>
<u>Electric Storage Water heaters</u>	<u>40-120 gallons</u>	<u>ANSI/CTA-2045-B Level 1 and also capable of initiating water heating to meet the temperature set point in response to a demand response signal.</u>	<u>ANSI/CTA-2045-B Level 2, except "Price Stream Communication" functionality as defined in the standard.</u>

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Revise as follows:

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

Reason Statement: Water heaters can provide significant load shifting and energy storage capacity in many building types. ANSI/CTA-2045

standardizes the socket, and communications protocol, for heat pump water heaters so they can communicate with the electricity grid other demand response signal providers. In addition, 2045 adds control and communications requirements for mixing valves in HPWH to enable them to provide greater storage capacity to support increased load shifting. The addendum also creates a definition of demand responsive control to ensure its consistent use throughout the code. ANSI/CTA-2045 is the industry standard for demand responsive controls for water heaters, but the requirement allows for other protocols to be approved by the building official.

This proposal requires that water heaters with integrated storage tanks have this demand control functionality. The requirement is limited to electric water heaters with integrated storage tanks. It only applies to water heaters over 20 gallons in order to exclude small, point-of-use water heaters; these water heaters also only have very small capacity for demand response. Water heaters in health care facilities are also exempted since the hot water provided can be considered a part of health care. The requirement would also not apply to large water heating systems, as they generally have separate storage tanks. These water heaters subject to this requirement generally serve lavatories and kitchenettes in commercial buildings and some water heating approaches in mid-rise residential. Grid flexibility is one of the foundations of achieving meaningful decarbonization of building energy as it is an essential element of decarbonizing the electrical grid. Carbon free energy sources like solar and wind have varying production over the course of the day and the year. Demand responsive controls that can respond to demand response signals enable buildings to shape their loads to better align with available energy production. This could come in the form of curtailing energy use when demand is high or utilizing excess production for building tasks like pre-conditioning spaces or service hot water when demand is lower. Demand control functionality will also present a cost-saving opportunity for buildings in the future.

More and more utilities are moving beyond voluntary programs and are expanding use of time-of-use rates for electricity as a tool for shaping demand. Installing demand-responsive lighting controls now will allow building tenants and owners to better control their utility costs. Since this requirement is part of the construction code, it will not require buildings to participate in any demand response programs. But it will ensure that buildings are capable of participating, so that VA buildings will be able to help integrate building loads with available production.

Resiliency Impact Statement: This proposal will increase Resiliency

Demand responsive controls allow for utilities to send and buildings to receive signals to ramp up or down set points based on a variety of conditions. This communication ability is a critical aspect of resilience for our communities.

Storage water heaters have a unique capability to act as thermal storage "batteries". By allowing water heaters to receive a signal from the grid, water can be heated at a time when overall demand, price signals or carbon emissions are at their lowest. Pre-heating water in this way can help to lessen peak demands on the grid, creating grid resiliency, reduce costs for consumers, creating financial resiliency, and help absorb excess renewable generation, or at a minimum engage during the cleanest hours of generation, reducing carbon emissions and climate impact of water heating.

Cost Impact: The code change proposal will increase the cost of construction

Grid-integrated controls for water heaters which costs around \$173 become cost effective when enrolled in a demand response program. Armada Power customers in Ohio who enrolled their water heaters in a demand response program saved \$184 annually by enrolling in the program. If utilities nationwide instituted a similar program to shape demand, a customer could reap \$12 in energy cost savings for every \$1 spent on the additional controls

EC-C405.4-21

IECC@: SECTION 202, SECTION 202 (New), C405.4

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org)

2021 International Energy Conservation Code

Revise as follows:

GREENHOUSE. A structure or a thermally isolated area of a building that maintains a specialized sunlit environment with a skylight roof ratio of 50% or more above the growing area exclusively used for, and essential to, the cultivation, protection or maintenance of plants. *Greenhouses* are those that are erected for a period of 180 days or more.

Add new text as follows:

HORTICULTURAL LIGHTING.

Electric lighting used for horticultural production, cultivation or maintenance.

PHOTOSYNTHETIC PHOTON EFFICACY (PPE). Photosynthetic photon flux emitted by a light source divided by its electrical input power in units of micromoles per second per watt, or micromoles per joule ($\mu\text{mol}/\text{J}$) between 400-700nm as defined by ANSI/ASABE S640.

Revise as follows:

C405.4 Lighting for plant growth and maintenance. ~~Not less than 95 percent of the permanently~~ Permanently installed luminaires used for plant growth and maintenance shall have a photosynthetic photon efficacy of not less than 1.7 $\mu\text{mol}/\text{J}$ for horticultural lighting in greenhouses and not less than 1.6 1.9 $\mu\text{mol}/\text{J}$ for all other horticultural lighting. Luminaires for horticultural lighting in greenhouses shall be controlled by a device that automatically turns off the luminaire when sufficient daylight is available. Luminaires for horticultural lighting shall be controlled by a device that automatically turns off the luminaire at specific programmed times.

~~efficiency as defined in accordance with ANSI/ASABE S640. efficiency a~~

Reason Statement: Indoor agriculture energy usage is projected to grow substantially nationwide over the next several years, driven in large part (but not entirely) by the legalization of medical and recreational marijuana across the country. This growth is going to occur rapidly in Virginia since Virginia legalized recreational marijuana on July 1, 2021. A total of 46 million square feet of grow area in the U.S. is lit by electric horticultural lighting, 58% of which was in supplemental greenhouses, 41% in non-stacked indoor farms, and 1% in vertical farms. Lighting in greenhouses operate on average 2,120 hours per year or 6 hours per day and lighting in non-stacked indoor operations were on 5,475 hours per year or 15 hours per day. Because of these long operating hours, lighting can account for 50 to 80% of a facilities energy use in indoor operations and 30% of energy use in greenhouses. Because sales of both recreational and medical marijuana are becoming legal across the country, it is critical to ensure these facilities are as efficient as possible. Because of the large opportunity for energy savings, the 2021 IECC has already adopted requirements for lighting in these applications using the efficiency metric of $\mu\text{mol}/\text{J}$ (micromoles per Joule) which was developed in collaboration with the American Society of Agricultural and Biological Engineers to measure the efficacy of lighting used for plant growth. A double-ended High Pressure Sodium (HPS) luminaire can meet the existing 2021 IECC standard of 1.6 $\mu\text{mol}/\text{J}$. The proposed requirement increases the efficacy level required to 1.9 $\mu\text{mol}/\text{J}$. This new efficacy standard does not require a technology shift within indoor horticulture because slightly more efficient double-ended HPS lamps that meet the existing standard can also meet the proposed standard. Because a technology shift is not required, the additional energy savings from increasing the standard from 1.6 $\mu\text{mol}/\text{J}$ to 1.9 $\mu\text{mol}/\text{J}$ for indoor operations is very cost-effective. This proposed amendment also institutes a lower efficacy requirement of 1.7 $\mu\text{mol}/\text{J}$ for greenhouses due to lower operating hours and thus longer payback periods in these applications. This amendment also introduces requirements for lighting controls that are able to turn off the luminaire at specific times during the day and a lighting control requirement for greenhouses to ensure lights are off when sufficient daylight is available. Finally, the amendment clarifies these requirements by introducing horticultural lighting and photosynthetic photon efficacy as new definitions and by amending the definition for greenhouse. These requirements are consistent with proposed Addendum ar-2019 recently released for public review to ASHRAE Standard 90.1 and with code requirements proposed for inclusion in Section 120.6(h)2 of California's Title 24-2022. The Technical Advisory Groups in Minnesota, Washington State, and Washington D.C. are also recommending these efficacy requirements as amendments to their local commercial energy codes. This proposal was also approved by the IECC Consensus Committee.

References:

Energy Savings Potential of SSL in Horticultural Applications. U.S. Department of Energy, Dec. 2017, https://www.energy.gov/sites/prod/files/2017/12/f46/ssl_horticulture_dec2017.pdf.

Schimelpfenig, Gretchen. Energy Efficiency for Massachusetts Marijuana Cultivators, Resource Innovation Institute, Sept. 2020, resourceinnovationinstitute.wildapricot.org/RII-REPORTS/.

Final CASE Report: Controlled Environment Horticulture, California Statewide Codes and Standards Enhancement (CASE) Program, Oct. 2020,

<https://title24stakeholders.com/wp-content/uploads/2020/10/2022-T24-NR-CEH-Final-CASE-Report.pdf>.

15-Day Express Terms 2022 Energy Code - Residential and Nonresidential, California Energy Commission, 14 July 2021, <https://efiling.energy.ca.gov/GetDocument.aspx?tn=238848>.

Proposed Addendum ar to Standard 90.1-2019, Energy Standard for Buildings Except Low-Rise Residential Buildings, ASHRAE, Aug. 2021, [http://osr.ashrae.org/Online-Comment-Database/ShowDoc2/Table/DocumentAttachments/FileName/3689-90.1\(2019\)ar%20PPR1%20Draft.pdf/download/false](http://osr.ashrae.org/Online-Comment-Database/ShowDoc2/Table/DocumentAttachments/FileName/3689-90.1(2019)ar%20PPR1%20Draft.pdf/download/false).

Resiliency Impact Statement: This proposal will increase Resiliency

Resiliency is an essential component of adapting to the effects of climate change. As we see increasing number of severe weather events, the electric grid's ability to withstand these events will become increasingly important. Indoor agricultural facilities place a huge demand on the local energy supply, rivaling that of data centers. The lighting proposal will significantly reduce energy demand of these facilities and therefore increase resiliency by reducing overall demand on the local grid where facilities are being added.

Cost Impact: The code change proposal will increase the cost of construction

This proposal will result in no additional cost for growers using greenhouses because there is little to no cost difference between luminaires meeting the current 2021 IECC requirement of 1.6 $\mu\text{mol}/\text{J}$ and the proposed requirement of 1.7 $\mu\text{mol}/\text{J}$ and because lighting control requirements are already common practice for these applications. For indoor grow operations, the cost of purchasing a luminaire that meets a 1.9 $\mu\text{mol}/\text{J}$ requirement vs a 1.6 $\mu\text{mol}/\text{J}$ would result in increased costs of approximately \$13/square foot. Assuming an electricity rate of 11.09 cents/kWh, annual energy cost savings from this code proposal is approximately \$4.55/square foot resulting in a three-year simple payback period.

References:

Morlino, Lauren, Emerging Technologies & Services Manager at Vermont Energy Investment Corporation . Re: Cost Information for VT Luminaires, 21 June 2021.

Final CASE Report: Controlled Environment Horticulture, California Statewide Codes and Standards Enhancement (CASE) Program, Oct. 2020, <https://title24stakeholders.com/wp-content/uploads/2020/10/2022-T24-NR-CEH-Final-CASE-Report.pdf>.

EC-C405.10-21

VECC: C202 (New), C405.10 (New), C405.10.1 (New), C405.10.1.1 (New), C405.10.1.2 (New), Table C405.10.1 (New), C405.10.2 (New), Table R405.10.2 (New), C405.10.3 (New)

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

C202 General Definitions (Commercial), SECTION C202 GENERAL DEFINITIONS

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, electric motorcycles and the like, which is primarily powered by an electric motor that draws current from a rechargeable storage battery. A "plug-in hybrid" is a type of electric vehicle which relies on a combination of a rechargeable storage battery and another source of motive power.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or charging apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. A designated parking space which is provided with electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for EVSE, and with an adequately-sized raceway from the panel to a clearly identified location within three feet of the parking space, to support future EVSE.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit and adequate electric panel capacity and space to electrify EVSE. The circuit shall terminate in a suitable termination point, such as a receptacle, junction box, or an EVSE, located within three feet of the parking space.

C405.10 Electric Vehicle (EV) charging for commercial construction. New construction shall provide and facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70).

Exception: EVSE Installed, EV Ready Spaces and EV Capable Spaces are not required where no parking spaces are provided to residents.

C405.10.1 Large Residential Buildings. Residential buildings not covered by R404.2 shall provide EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces as set forth in C405.10.1.1 and C405.10.1.2. **Exception:** EVSE Installed, EV Ready Spaces and EV Capable Spaces are not required where no parking spaces are provided to occupants.

C405.10.1.1 Multifamily. Multifamily buildings not covered by R404.2 (N1104.2) shall provide EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces in proportion to the number of dwelling units in accordance with Table C405.10.1, such that the total number of such spaces equals the number of dwelling units for which parking spaces are made available to residents. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a multifamily project is built in phases, the minimum number of required spaces shall be determined separately for each phase. EVSE shall be installed as residents of dwelling units acquire EVs and request EV charging facilities. Raceways to outdoor parking spaces shall be located underground and protected from water.

C405.10.1.2 Hotels and transient lodging . Hotels and other transient lodging shall construct EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces in proportion to the number of sleeping units in accordance with Table C405.10.1, such that the total number of such spaces equals the number of sleeping units for which parking spaces are made available to occupants. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a hotel or covered lodging is built in phases, the minimum number of required spaces shall be determined separately for each phase. Raceways to outdoor parking spaces shall be located underground and protected from water.

Table C405.10.1

Minimum EVSE Installed, EV Ready and EV Capable Spaces in Large Residential Buildings. .

Type of space	Minimum number of spaces installed at completion of construction or phase of construction
EVSE Installed Spaces	Greater of 1 or 15% of total number of dwelling units or sleeping units
EV Ready Spaces	Greater of 1 or 15% of total number of dwelling units or sleeping units
EV Capable Spaces	Total number of dwelling units or sleeping units minus the sum of (EVSE Installed and EV Ready spaces)

C405.10.2 Non-Residential Construction . . To the extent new construction provides parking spaces for employees in mixed-use or other buildings, EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table C405.10.2. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a project is built in phases, the minimum number of required spaces shall be determined separately for each phase. If parking spaces are planned to be shared by residents and employees in the same or different buildings, based on diversity of time utilization, then the total parking spaces with EVSE Installed, EV Ready and EV Capable Spaces will be the greater of the number of such category of spaces in Table R405.10.1 and Table R405.10.2. **Exception:** EVSE Installed, EV Ready Spaces and EV Capable Spaces are not required by this section if no parking spaces are provided to employees.

Table R405.10.2 Minimum EVSE Installed, EV Ready and EV Capable Spaces for Non-Residential Parking.

Type of space	Minimum number of spaces installed at completion of construction or phase of construction
EVSE Installed Spaces	Greater of 1 or 10% of total number of spaces for employees
EV Ready Spaces	Greater of 1 or 10% of total number of spaces for employees
EV Capable Spaces	20% of remaining parking spaces for employees

C405.10.3 Identification. The service panel or subpanel circuit directory shall identify the spaces reserved to support EV charging as “EVSE Installed,” “EV Capable” or “EV Ready” and shall be updated as EVSE Installed Spaces are created. The raceway location shall be permanently and visibly marked as “EV Capable”. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

Reason Statement: This provision is designed to provide electric charging readiness for the growing use of electric vehicles (EVs) and to meet the essential need to offer at-home charging to residents and at-work charging for workers many of whom own EVs or will own EVs in the next few years. It is designed to minimize costs through phasing of EV development, with an emphasis on installing infrastructure during initial construction. To limit costs, the proposal only addresses the needs of residents and employees, not the potential EV interests of customers or visitors.

In the case of multifamily construction, the proposal requires defined numbers of initial EV Installed, EV Ready spaces and EV Capable Spaces. The total of the three categories is tied to the number of dwelling units which are eligible for parking so that all residents have an opportunity to charge an EV when one is acquired. The intent is to provide a modest number of EV Installed and EV Ready Spaces from the outset, with EV Capable Spaces for the remainder up to the number of dwelling units for which parking is provided. Buildings that house individuals receiving medical or other care may not provide parking to serve residents of all dwelling units. The proposal will benefit residents and the public, saving money and cutting pollution.

Hotels, motels and other places of temporary lodging are important to travelers, many of whom will drive to the place of lodging, need to recharge overnight and move on. The proposal would tie the number of EVSE Installed, EV Ready and EV Capable spaces to the number of sleeping units (rather than dwelling units). Once the infrastructure is in place, the hotel would be readily able to expand EVSE services as demand grows.

Places of employment also need some level of EV charging at the workplace to accommodate employees’ commuting needs. The proposal would not require as many at-work chargers on the assumption that some employees will be able to charge at home. Charging along the highway is a slow, less-convenient process than charging a vehicle while at work or at home.

EVs are growing in importance and will continue to grow in importance as climate risks compel shifting to vehicles that do not emit pollution and as

more people recognize the potential value of owning or leasing EVs. EVs will save EV users up to \$1900 per year in operating expenses compared to traditional vehicles.[1] Those operating savings will encourage EV sales growth and will greatly exceed the costs of pre-wiring garages and installing other necessary infrastructure during construction. Installing during construction is much cheaper than doing so by retrofit.

Vehicles are Virginia's largest source of carbon-dioxide emissions from fossil fuel combustion.[2] Even based on today's mix of generation in Virginia, DOE estimates that EVs would reduce CO2 emissions by roughly two-thirds compared to vehicles combusting gasoline.[3] Emissions from generation that supplies EVs will decline more as utilities' zero-carbon renewable energy replaces fossil-fuel generation. EVs' direct emissions are non-existent, which also has substantial health and pollution benefits compared to gasoline or diesel vehicles. Furthermore, in addition to the EV user's savings on annual operating costs (energy and maintenance), EV charging during off-peak periods can lead to a reduction of electric rates to all utility customers.[4] There is a national goal to have 50% of new vehicles to be EVs by 2030.[5] Major vehicle manufacturers have committed to shift production to EVs over the next 10 years with a number of manufactures committing to shift to 100% EV production in the next 5-10 years. [6] At-home charging in conjunction with single or multifamily parking is particularly important to meeting the needs of EV owners and to encourage charging during utilities' off-peak periods. According to research by JD Power, "80% of EV charging is done at home—almost always overnight—or while a car is parked during the workday" and EV users strongly prefer Level 2 (220/240V) charging. [7] The capability for at-home charging will substantially reduce barriers to EV adoption that arise from the inconveniences that EV charging is slower than pumping gasoline, the public infrastructure for charging is still limited, and drivers have limited ability to take advantage of off-peak rates without home-charging. The need for convenient overnight charging is as important for travelers as for residents. Going forward, utilities may get the added benefit of being able to draw on the batteries of parked electric vehicles in order meet peak demands and balance fluctuating loads.

Installing the wiring and basic infrastructure during construction when walls are open, parking is being constructed and workers are present is much cheaper. Experience shows that installing a simple 220V/40 Ampere outlet (comparable to a dryer or stove outlet) for "Level 2" EV charging, in a garage or outside close to parking spaces (e.g., on a wall near a single-family driveway), will enable an EV owner to reliably charge an EV at home, scheduling it at night or otherwise outside the utilities peak demand period for the lowest rates. The same is true for employees who commute with EVs. The presence of the wiring from the beginning would permit low-cost installation of a different charging system preferred by the EV owner. Failure to install the EV during infrastructure will create barriers to EV adoption and to the cost and pollution reductions that will come from EV utilization. Those barriers will be particularly great in the context of multifamily dwellings where retrofit costs are much higher and landlords' interests conflict with those of tenants.

[1] See Consumer Reports, "EVs Offer Big Savings Over Traditional Gas-Powered Cars" (October 2020); Union of Concerned Scientists, <https://www.ucsusa.org/about/news/rural-communities-could-benefit-most-electric-vehicles> (up to \$1900/year savings for rural EV owners); <https://augustafreepress.com/deq-launches-clean-air-communities-program-aimed-at-driving-investment-in-electric-vehicle> The police department of Westport Connecticut achieved operating and maintenance savings of over \$17,000 in its first year of using a Tesla Model 3 police car instead of a fossil fuel vehicle. Among the department's conclusions: after four years the Tesla will have saved enough money to buy another Tesla, and each EV avoids emission of over 23 tons of CO2 per year and saves \$8763 in environmental and health costs. <https://www.teslarati.com/tesla-model-3-westport-police-department-financial-analysis/>

[2] https://www.epa.gov/sites/production/files/2019-11/documents/co2ffc_2017.pdf

[3] DOE estimates that an EV in Virginia emits (via electric generation) less than a third as much CO2 as a gasoline-driven vehicle. https://afdc.energy.gov/vehicles/electric_emissions.html ; <https://evtool.ucsusa.org/>

[4] See June 23, 2020 Comments of the Sierra Club to the State Corporation Commission in SCC Docket PUR-2020-00051, Electrification of Motor Vehicles. As the comments explain, with managed off-peak charging and efficient rate structures, rising EV loads can drive down rates to all customers. Regarding operating costs, an EV has very little maintenance costs and EV's electricity cost equivalent to a gallon of gasoline, in Virginia, was \$1.16 versus roughly \$4.00/gallon today. <https://www.energy.gov/maps/egallon>

[5] <https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/>

[6] EV sales are already increasing, and every major vehicle manufacturer has committed to expand EV production and even to go all-electric over the next decade or so. Electric pick-up trucks will soon be available and there are long waiting lists for pick-ups. See <https://www.reuters.com/business/autos-transportation/us-automakers-say-they-aspire-up-50-ev-sales-by-2030-sources-2021-08-04/> <https://www.forbes.com/wheels/news/automaker-ev-plans/> ; <https://www.cnn.com/2022/01/05/chrysler-kicks-off-plans-to-go-all-electric-by-2028-with-airflow-concept.html> <https://www.electrive.com/2021/08/05/us-carmakers-aim-for-40-50-ev-sales-by-2030/>

[7] <https://www.forbes.com/wheels/news/jd-power-study-electric-vehicle-owners-prefer-dedicated-home-charging-stations/> See also James Walkinshaw, Washington Post, Jan. 23, p.C4 (explaining the importance of home charging relative to public charging). Utilities' energy sales are lowest and cheapest in off-peak hours, particularly at night. A common utility strategy is to offer time-of-use rates with low night-time prices to encourage off-peak EV charging. For EV customers to make use of such incentives, they will need access to overnight charging at home where they spend the night.

Resiliency Impact Statement: This proposal will increase Resiliency
Expanding EV utilization will enhance resiliency in multiple ways.

It is anticipated that EV batteries can be connected to the grid to provide grid balancing and back up in the future.

Switching to EVs is also critical to resiliency because it will reduce CO₂, CO, SO₂, particulates, methane, and other harmful emissions from fossil-fuel combustion vehicles and from producing and delivering gasoline and diesel fuel for use in vehicles. Unlike traditional vehicles with internal combustion engines ("ICE"), electric vehicles emit no air pollution and are much more energy efficient than ICE vehicles. As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow.

According to Virginia's DEQ, "[t]he transportation sector is now the largest contributor of air pollutants and greenhouse gases in Virginia," and "[v]ehicle emissions are the largest single source of toxic and smog-forming air pollution in Northern Virginia and much of the rest of the country."

<https://www.deq.virginia.gov/air/clean-vehicles>. Transportation accounts for 48.6% of Virginia's CO₂ emissions.

<https://www.eia.gov/environment/emissions/state/>

Polluting emissions from internal combustion vehicles compound the risks of climate change and adversely impact public health. CO₂ and other emissions from fossil fuel combustion and production are the primary drivers of climate change. The most recent IPCC report confirms that rapid reductions of greenhouse gas emissions is essential to avoid catastrophic climate impacts around the world. IPCC Sixth Assessment Report (February 2022), <https://www.ipcc.ch/report/ar6/wg2/> Substantial harm has already occurred nationally and locally from global warming and much worse will follow without rapid reductions of greenhouse gases (particularly CO₂ and methane associated with fossil fuel production and combustion). Virginia's coastal areas are among the most vulnerable to sea level rise and destructive storms. They already experience "sunny day flooding," and sea level rise is accelerating. https://www.vims.edu/newsandevents/topstories/2020/slrc_2019.php Climate change is already harming Virginia and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO₂ and methane associated with fossil fuel production and combustion). The most recent report from NOAA indicates that Virginia may face 2 feet of sea level rise by 2050 due to worsening climate change from human greenhouse gas emissions. <https://www.noaa.gov/news-release/us-coastline-to-see-up-to-foot-of-sea-level-rise-by-2050> Virginia faces climate-driven sea level rise of 6.69 feet this century; the rate of sea level rise is accelerating; the danger of climate-driven severe storms, storm-surges and flooding are rising; and climate change will increasingly harm human health and lives, agriculture, businesses, military installations, private and public property, and Virginia's economy. <http://www.vasem.org/reports/2021-the-impact-of-climate-change-on-virginias-coastal-areas/> Growing dangers also include rising atmospheric and water temperatures that worsen heat-related illnesses, disruptions of economic activity, and harms to agriculture, fisheries, and our natural heritage.

Because atmospheric CO₂ from emissions is cumulative, Virginia has less chance of mitigating and recovering from those harms the longer we delay maximizing energy savings and minimizing greenhouse gas pollution.

Shifting to EVs is a critical piece of the solution to global warming. Continuing to construct buildings that will not support use of clean EVs will make it harder to achieve climate goals, particularly since the buildings will likely remain in place for 70 years or more. Constructing buildings that cannot provide electric charging will also delay residents' ability to access large economic and energy savings from EV usage.

Building codes already recognize that fumes from traditional vehicles are dangerous. More broadly, small particle, SO₂ and other pollution from vehicles burning fossil fuels increases heart and lung disease, as well as cognitive and other disorders. <https://blog.ucsusa.org/dave-reichmuth/air-pollution-from-cars-trucks-and-buses-in-the-u-s-everyone-is-exposed-but-the-burdens-are-not-equally-shared/> As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow particularly if we shift vehicles to clean electricity. Local air pollution harms caused by vehicle pollution will also be reduced which will particularly benefit high-traffic areas, including low-income urban areas.

Cost Impact: The code change proposal will increase the cost of construction

This code change proposal will somewhat increase the cost of constructing parking, but the increase will be small compared to the total cost of building construction and to the benefits to residents, employees and the public. EVs with at-home charging or at-work charging will save the users money and avoid the higher costs of retrofitting in the future.

The incremental cost of installing the electric equipment will be low when a residence is constructed. It is easy to install the wires, panel capacity and conduits for electric vehicle charging--along with the rest of a dwelling's wiring--when parking for multifamily dwelling or a nonresidential building is being constructed. It is much harder and much more expensive to do so as a retrofit. The branch circuit would cost a few dollars per foot, and raceways are also inexpensive.

In a large multifamily building, the cost would be greater than for a single-family dwelling due the larger garage or parking lot size and possibly the garage design. However, the costs of the infrastructure required by the proposal are still low compared to the overall construction cost, to potential retrofit costs, to residents' long-term savings from EVs, and to harm from impeding tenants' ability to reduce carbon and other pollutants which will reduce pollutants and benefit the public. The cost can be minimized by locating the EVSE (or future location for the EVSE) close to the electrical panels. The proposal limits the costs both by limiting the requirements to one covered space per dwelling unit and to a limited number of spaces planned for employees and by deferring of much of the costs with respect to EV Ready and EV Capable spaces.

In the case of multifamily projects, the proposed multifamily requirements are tied to the number of dwelling units and staged as spelled out in the Table, so that residents of every dwelling unit will have the opportunity to home-charge an EV, and the remaining electrical wiring and charger costs would only be incurred as occupant demand grows. The requirements for non-residential buildings are likely to be less than for multifamily. In submissions to the IECC as part of the 2021 IECC review process, data indicated that the cost of retrofitting commercial parking to EV ready status would be 3-8 times higher than doing to work at the time of building construction. See IECC Proposal CE217-19 Part 1(Cost Impact discussion). Such high retrofit costs will deter future retrofits and act as a barrier to EV access by residents of multifamily dwellings, potentially for decades.

EC-C405.13-21

IECC®: SECTION 202 (New), C405.13 (New), C405.13.1 (New), C406.5, TABLE C407.4.1(1)

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

RENEWABLE ENERGY CERTIFICATE (REC). An instrument that represents the environmental attributes of one megawatt-hour of renewable electricity; also known as an energy attribute certificate (EAC).

C405.13 Renewable energy systems.

Each building site shall have equipment for on-site renewable energy with a rated capacity of not less than 0.25 W/ft² (2.7 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors.

Exceptions:

1. Any building located where an unshaded flat plate collector oriented towards the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m²·day (1.1 kBtu/ft²·day).

2. Any building where more than 80 percent of the roof area is covered by any combination of equipment other than for on-site renewable energy systems, planters, vegetated space, skylights, or occupied roof deck.

3. Any building where more than 50 percent of roof area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2,500 annual hours between 8:00 AM and 4:00 PM.

C405.13.1 Renewable energy certificate documentation. Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.

C405.13.1 Additional efficiency package options. The PV capacity required in this section shall not be used for compliance with the on-site renewable energy option of Section C406.5.

Revise as follows:

C406.5 On-site renewable energy. Buildings shall comply with Section C406.5.1 or C406.5.2. The total minimum ratings of on-site renewable energy systems, not including onsite renewable energy system capacity used for compliance with Section C405.13, shall be one of the following

TABLE C407.4.1(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with Table C405.3.2(1) or C405.3.2(2) for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
Roofs	Type: insulation entirely above deck	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, above-grade	Type: same as proposed	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, below-grade	Type: mass wall	As proposed
	Gross area: same as proposed	As proposed
	U-Factor: as specified in Table C402.1.4 with insulation layer on interior side of walls	As proposed
Floors, above-grade	Type: joist/framed floor	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
Floors, slab-on-grade	Type: unheated	As proposed
	F-factor: as specified in Table C402.1.4	As proposed
Opaque doors	Type: swinging	As proposed
	Area: Same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
Vertical fenestration other than opaque doors	Area	As proposed
	1. The proposed vertical fenestration area; where the proposed vertical fenestration area is less than 40 percent of above-grade wall area.	
	2. 40 percent of above-grade wall area; where the proposed vertical fenestration area is 40 percent or more of the above-grade wall area.	
	U-factor: as specified in Table C402.4	As proposed
	SHGC: as specified in Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	External shading and PF: none	As proposed

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN				
Skylights	<p>Area</p> <table border="1" data-bbox="326 247 777 449"> <tr> <td data-bbox="326 247 354 344">1.</td> <td data-bbox="354 247 777 344">The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1.</td> </tr> <tr> <td data-bbox="326 344 354 449">2.</td> <td data-bbox="354 344 777 449">The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1.</td> </tr> </table>	1.	The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1.	2.	The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1.	As proposed
	1.	The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1.				
	2.	The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1.				
	U-factor: as specified in Table C402.4	As proposed				
SHGC: as specified in Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed					
Lighting, interior	The interior lighting power shall be determined in accordance with Section C405.3.2. Where the occupancy of the building is not known, the lighting power density shall be 1.0 watt per square foot based on the categorization of buildings with unknown space classification as offices.	As proposed				
Lighting, exterior	The lighting power shall be determined in accordance with Tables C405.5.2(1), C405.5.2(2) and C405.5.2(3). Areas and dimensions of surfaces shall be the same as proposed.	As proposed				
Internal gains	Same as proposed	Receptacle, motor and process loads shall be modeled and estimated based on the space use classification. End-use load components within and associated with the building shall be modeled to include, but not be limited to, the following: exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators, escalators, refrigeration equipment and cooking equipment.				
Schedules	Same as proposed Exception: Thermostat settings and schedules for HVAC systems that utilize radiant heating, radiant cooling and elevated air speed, provided that equivalent levels of occupant thermal comfort are demonstrated by means of equal Standard Effective Temperature as calculated in Normative Appendix B of ASHRAE Standard 55.	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any seasonal operation. Schedules shall model the time-dependent variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.				
Mechanical ventilation	Same as proposed	As proposed, in accordance with Section C403.2.2.				
Heating systems	Fuel type: same as proposed design	As proposed				
	Equipment type ^a : as specified in Tables C407.4.1(2) and C407.4.1(3)	As proposed				
	Efficiency: as specified in the tables in Section C403.3.2.	As proposed				
	Capacity ^b : sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed				

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type ^c : as specified in Tables C407.4.1(2) and C407.4.1(3)	As proposed
	Efficiency: as specified in Tables C403.3.2(1), C403.3.2(2) and C403.3.2(3)	As proposed
	Capacity ^b : sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer ^d : same as proposed, in accordance with Section C403.5.	As proposed
Service water heating ^e	Fuel type: same as proposed	As proposed
	Efficiency: as specified in Table C404.2	For Group R, as proposed multiplied by SWHF. For other than Group R, as proposed multiplied by efficiency as provided by the manufacturer of the DWHR unit.
	Capacity: same as proposed	As proposed
	Where no service water hot water system exists or is specified in the proposed design, no service hot water heating shall be modeled.	
<u>On-site Renewable Energy</u>	<u>Where a system providing on-site renewable energy has been modeled in the proposed design the same system shall be modeled identically in the standard reference design except the rated capacity shall meet the requirements of Section C405.13</u>	As proposed
	<u>Where no system is designed or included in the proposed design, model an unshaded photovoltaic system with the following characteristics:</u>	
	<u>Size: Rated capacity per Section C405.13</u>	
	<u>Module Type: Crystalline Silicon Panel with a glass cover, 19.1% nominal efficiency and temperature coefficient of -0.35%/°C. Performance shall be based on a reference temperature of 77° F (25° C), air mass of 1.5 atmosphere and irradiance of 317 Btu/h-ft² (1000 W/m²).</u>	
	<u>Array Type: Rack mounted array with installed nominal operating cell temperature (INOCT) of 103° F (45° C).</u>	
	<u>Total System Losses (DC output to AC output): 11.3%.</u>	
	<u>Tilt: 0-degrees (mounted horizontally).</u>	
	<u>Azimuth: 180 degrees.</u>	

For SI: 1 watt per square foot = 10.7 w/m².

SWHF = Service Water Heat Recovery Factor, DWHR = Drain Water Heat Recovery.

- a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.

- b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.
- c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.
- d. If an economizer is required in accordance with Table C403.5(1) and where no economizer exists or is specified in the proposed design, then a supply-air economizer shall be provided in the standard reference design in accordance with Section C403.5.
- e. The SWHF shall be applied as follows:
 1. Where potable water from the DWHR unit supplies not less than one shower and not greater than two showers, of which the drain water from the same showers flows through the DWHR unit then $SWHF = [1 - (DWHR \text{ unit efficiency} \times 0.36)]$.
 2. Where potable water from the DWHR unit supplies not less than three showers and not greater than four showers, of which the drain water from the same showers flows through the DWHR unit then $SWHF = [1 - (DWHR \text{ unit efficiency} \times 0.33)]$.
 3. Where potable water from the DWHR unit supplies not less than five showers and not greater than six showers, of which the drain water from the same showers flows through the DWHR unit, then $SWHF = [1 - (DWHR \text{ unit efficiency} \times 0.26)]$.
 4. Where Items 1 through 3 are not met, $SWHF = 1.0$.

Reason Statement: In order to meet the state's 2045 carbon neutrality goal, Virginia must not only reduce energy use through energy efficiency but also move to utility scale and on-site renewable energy. In 2020, renewable energy sources were responsible for 21% of U.S. electricity generation. In order to cost-effectively achieve Virginia's goal to achieve carbon neutrality by 2045, it is paramount to begin installing a nominal capacity of renewable energy on-site in all new buildings now. According to a recent study entitled "A New Roadmap for the Lowest Cost Grid", the least expensive grid involves a large amount of centralized renewables and a large amount of distributed renewables located on the building site. More renewables placed onsite can enable the efficient deployment of rapidly expanding utility-scale renewables. It is therefore crucial for new commercial buildings to install renewable energy on-site during new construction so that the U.S. can reach its 100% carbon-free power sector goal in the most cost-effective manner. Installing renewables on site will also allow building owners to economically benefit from the transition towards a low-carbon economy, to prepare their building for expansion of renewable capacity, and to benefit from additional resiliency during disruptions in centrally supplied power. In addition, this proposal will expand good paying jobs in one of the nation's fastest growing employment sectors. According to the Bureau of Labor Statistics, the two fastest growing occupations in the US in 2019 were solar PV installers and wind turbine service technician. The Interstate Renewable Energy Council estimates that to reach Biden's target of 100% renewable energy by 2035, the industry will need to employ three times the number of workers employed in 2020.

This code proposal change is based on approved ASHRAE addenda by, ck, and cp to Standard 90.1-2019 which will be published in ASHRAE Standard 90.1-2022 and a recent technical brief developed by PNNL in support of further revisions to 90.1. Proposed definitions clarify renewable energy requirements for community renewable energy facility, financial renewable power purchase agreement, physical power purchase agreement and renewable energy credits. The proposal more closely aligns these definitions with language under consideration both in ASHRAE Standard 228P, The Standard Method of Evaluating Zero Energy Building Performance, and in ASHRAE Standard 189.1, which will be the basis of the 2024 IgCC.

The addenda establishes a prescriptive requirement for onsite renewable energy of 1.5W/s.f. of the three largest floors of all commercial buildings. The size of the required on-site renewable energy will supply on average 30% of building energy use. The recent technical brief from PNNL indicates there is enough roof space to meet this requirement for the vast majority of commercial buildings. If there is insufficient roof space or substantial shading, building owners are allowed to be exempted from on-site renewable energy requirements if they procure an equivalent amount of renewable energy off-site from a community renewable energy facility, a physical power purchase agreement or a financial power purchase agreement.

The proposal also requires building owners to retain any renewable energy credits (RECS) so that no other individual or organization can claim or take credit for the production from the system (thus preventing double-counting). REC documentation requirements are based on those currently in R406.7.3 of the 2021 IECC and 701.4.1.1.1 of the 2021 IgCC, and revisions pending for ASHRAE Standard 189.1-2023.

Finally, this proposal includes requirements to illustrate raceways used for the renewable energy system in construction documents and revises section C406.5 to prevent double-counting of the minimum renewable energy requirements in section C405.

References:

Renewables Became the Second-Most Prevalent U.S. Electricity Source in 2020 , U.S. Energy Information Administration, <https://www.eia.gov/todayinenergy/detail.php?id=48896>.

Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies, The White House, 22 Apr. 2021, <https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/>.

Why Local Solar For All Costs Less: A New Roadmap for the Lowest Cost Grid, Vibrant Clean Energy, Dec. 2020, [www.vibrantcleanenergy.com/wp-content/uploads/2020/12/ https://irecusa.org/wp-content/uploads/2021/07/National-Solar-Jobs-Census-2020-FINAL.pdf](http://www.vibrantcleanenergy.com/wp-content/uploads/2020/12/https://irecusa.org/wp-content/uploads/2021/07/National-Solar-Jobs-Census-2020-FINAL.pdf). WhyDERs_ES_Final.pdf.

The National Solar Job Census 2020, Interstate Renewable Energy Council, May 2021,

Richardson, Jake. Solar and Wind Tech Are the Fastest Growing Jobs in US, Red, Green, and Blue, 28 Jan. 2019, <http://redgreenandblue.org/2019/01/27/solar-wind-tech-fastest-growing-jobs-us/>.

ANSI/ASHRAE/IES Addendum by, ck, and cp to ANSI/ASHRAE/IES Standards 90.1-2019, ASHRAE Standards Committee, 31 July 2020, https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_by_ck_cp_202007

Resiliency Impact Statement: This proposal will increase Resiliency

Resiliency is an essential component of adapting to the effects of climate change. As we see increasing number of severe weather events, the electric grid’s ability to withstand these events will become increasingly important. Community resilience will be increasingly dependent on distributed generation, and more localized production can help buildings and communities keep power when other areas of the grid may be offline. This local production of power can support critical building functions – varying by building type and use during a resilience event – providing life supporting functions of small/at home medical devices that require on power, allowing for needed cell phone charging to stay in touch during an emergency, and literally keeping the lights on for safety and security.

Cost Impact: The code change proposal will increase the cost of construction

This proposed code change will increase cost of construction modestly for commercial buildings following the prescriptive pathway of the 2021 IECC. The following table lists the required size of the photovoltaic array and cost effectiveness of that array under this proposed code amendment for a set of prototype commercial buildings following the prescriptive pathway. Analysis of the approximate total installed costs for these photovoltaic system is estimated at \$2.20/W based on analysis by NBI and partners. The annual energy cost savings in the first year of production are based on generation estimated by NREL’s PVWatts in Minneapolis (which has below average solar radiation compared with the majority of the U.S.) and average U.S. electricity rates according to the U.S. EIA. The analysis indicates that this requirement would result in a payback time that is far less than the system lifetime.

	PV-System-Size- (kW)	PV-Cost/s.f.	Annual-Energy-Cost-Savings	Simple-Payback-Period- (yrs)
Small-Business (3-story, 10,000 s.f.)	2.5	\$5,070	\$410	12.4
Multifamily-High-Rise (10-story, 80,000 s.f.)	6.0	\$12,168	\$1,383	8.8
Office (4-story, 50,000 s.f.)	9.4	\$19,013	\$1,536	12.4

EC-C405.16-21

IECC®: C103.2.2 (New), C105.2.5, SECTION 202 (New), C405.16 (New), C406.1

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

C103.2.2 Electrification system. The construction documents shall provide details for additional electric infrastructure, including branch circuits, conduit, or pre-wiring, and panel capacity in compliance with the provisions of this code.

Revise as follows:

C105.2.5 Electrical system. Inspections shall verify lighting system controls, ~~components and components~~ meters, and additional electric infrastructure as required by the code, approved plans and specifications.

Add new text as follows:

ALL-ELECTRIC BUILDING. A building that contains no combustion equipment, or plumbing for combustion equipment, installed within the building or building site.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, service water heating, cooking, clothes drying and/or lighting that uses fuel gas or fuel oil.

COMMERCIAL COOKING APPLIANCES. Appliances used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries, and similar appliances. For the purpose of this definition, a food service establishment shall include any building or a portion thereof used for the preparation and serving of food.

EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

FUEL GAS. A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

MIXED-FUEL BUILDING. A building that contains combustion equipment or includes piping for such equipment.

C405.16 Additional electric infrastructure. C405.16 Additional electric infrastructure. Buildings that contain combustion equipment and end-uses shall be required to install electric infrastructure in accordance with this section.

C405.16.1 Electric infrastructure for dwelling and sleeping units. Combustion equipment and end-uses serving individual dwelling units or sleeping units shall comply with Section R404.6.

C405.16.2 Combustion space heating. Space heating equipment that uses fossil fuels shall comply with either C405.16.2.1 or C405.16.2.2.

C405.16.2.1 Unitized heating. Warm-air furnaces with a capacity less than 225,000 Btu/h and gas- and oil-fired boilers with a capacity less than 400,000 Btu/h shall be provided with a designated exterior location(s) in accordance with the following:

a. Natural drainage for condensate from cooling equipment operation or a condensate drain located within 3 feet (914 mm) of the location of the space heating equipment, and

b. A dedicated branch circuit in compliance with NFPA 70 Section 424.4 based on heat pump space heating equipment sized in accordance with the requirements of ANSI/ASHRAE/IES Standard 90.1, Section 6.4.2 and terminating within 3 feet (914 mm) of the location of the space heating equipment with no obstructions. Both ends of the branch circuit shall be labeled "For Future Heat Pump Space Heater."

Exception to C405.16.2.1(b): Where an electrical circuit in compliance with NFPA 70 Sections 440.4(B) and 440.35 exists for space cooling equipment.

C405.16.2.2 Central heating. All other space heating equipment shall be provided with conduit that is continuous between a junction box located

within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric equipment with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For Future Electric Space Heating Equipment".

C405.16.3 Combustion water heating. Water heating equipment that uses fossil fuels shall comply with either C405.16.3.1 or C405.16.3.2

C405.16.3.1 Unitized water heating. Water heaters with a capacity less than 300,000 Btu/h (88 kW) shall be installed in accordance with the following:

1. A dedicated 208/240-volt branch circuit with a minimum capacity of 30 amps shall terminate within 3 feet (914 mm) from the water heater and be accessible to the water heater with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Heat Pump Water Heater" and be electrically isolated.
2. A condensate drain that is no more than 2 inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within 3 feet (914 mm) of the water heater.
3. The water heater shall be installed in a space with minimum dimensions of 3 feet (914 mm) by 3 feet (914 mm) by 7 feet (2134 mm) high, and
4. The water heater shall be installed in a space with a minimum volume of 700 cubic feet (20,000 L) or the equivalent of one 16-inch (406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203 mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.

C405.16.3.2 Central water heating. Water heaters with a capacity greater than or equal to 300,000 Btu/h (88 kW) shall be provided with the following:

1. Conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric equipment with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For Future Electric Water Heating Equipment", and
2. A condensate drain that is no more than 2 inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within 3 feet (914 mm) of the water heater.

C405.16.4 Combustion cooking. Cooking equipment that use fossil fuel shall comply with either C405.16.4.1 or C405.16.4.2

C405.16.4.1 Commercial cooking. Commercial cooking appliances shall be provided with a dedicated branch circuit with a minimum capacity of 12 kVA per 1 kBtu of appliance input capacity. The branch circuit shall terminate within 3 feet (914 mm) of the appliance with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.

C405.16.4.2 Light and medium duty cooking. Light and medium duty cooking equipment not designated as commercial cooking appliances shall be provided with a dedicated branch circuit in compliance with NFPA 70 Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be accessible with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.

C405.16.5 Combustion clothes drying. Clothes drying equipment that use fossil fuels shall comply with either C405.16.5.1 or C405.16.5.2

C405.16.5.1 Commercial drying. Clothes drying equipment, and end-uses for commercial laundry applications shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric equipment with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For Future Electric Clothes Drying Equipment", and

C405.16.5.2 Residential drying. Clothes drying equipment, appliances, and end-uses serving multiple dwelling units or sleeping areas with a capacity less than or equal to 9.2 cubic feet shall be provided with a dedicated 240-volt branch circuit with a minimum capacity of 30 amps shall terminate within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be accessible with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Electric Clothes Drying Equipment" and be electrically isolated.

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Revise as follows:

C406.1 Additional energy efficiency credit requirements. New all-electric buildings shall achieve a total of 10 credits and new mixed-fuel buildings shall achieve a total of 15 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of Section C406. Where a building contains multiple-use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or

calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C405.12, include an energy monitoring system in accordance with Section C406.10.
10. Where not required by Section C403.2.3, include a fault detection and diagnostics (FDD) system in accordance with Section C406.11.
11. Efficient kitchen equipment in accordance with Section C406.12.

Reason Statement: In order to meet the state's 2045 carbon neutrality goal, Virginia must not only reduce energy use through energy efficiency and move to utility scale and on-site renewable energy, but also begin to transition away from using combustion equipment in buildings that runs on fossil fuels to electric equipment. Therefore it is crucial that new buildings today can be cost-effectively retrofitted in the future with electric equipment so that emissions are not "locked-in" by gas-dependent building infrastructure. Fortunately, heat pump technology has dramatically improved over the last few decades, giving contractors and building owners access to highly efficient electric heating and cooling, and water heating technologies.

One of the biggest expenses of electrification retrofits – and therefore barriers to electrification in existing buildings - is running electrical infrastructure through a completed and enclosed building that has combustion equipment. This significant future cost can be greatly reduced through making simple, low-cost modifications to buildings during construction that enable easier electrification in the future. The requirements in this proposed amendment ensure that the electrical infrastructure is in place so that building owners can convert to an all-electric building in the future and ensures that unitized gas water heaters can be replaced with high-performance heat pump water heaters (HPWHs).

Resiliency Impact Statement: This proposal will increase Resiliency

Electric ready infrastructure allows buildings the ability to take advantage of the greening grid while spreading out the costs. As noted in the reason statement, they will likely transition from fossil fuel to electric appliances over their lifespan. Although these buildings will require more electricity from the grid than their fossil fuel burning counterparts as they transition, they will be able to operate entirely on clean renewable energy.

By constructing electric-ready, building owners will additionally be given the tools they need to make decisions on the timing to switch fuel sources. As the costs of fuels change over time, owners will be ready to remove themselves from the volatility and geopolitics of the fossil fuel market.

Cost Impact: The code change proposal will increase the cost of construction

Virginia buildings that are all-electric would have no change in construction costs. Mixed fuel buildings would be slightly more expensive to build because they would both have to be electric-ready and meet additional efficiency requirements. Electric-ready requirements are anticipated to be nominal. Recent analysis by NBI and partners using cost data from RSMeans indicates that additional electrical infrastructure costs for water-heating and space-heating would cost a typical office building an additional \$8,380. However if a building owner were to have to retrofit their building from using combustion equipment to natural gas equipment costs without these requirements in place, costs could be exorbitant.

EC-C407.6-21

VECC: C407.6 (New), R406.8 (New), N1106.8 (New)

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

C407.6 Zero Energy Commercial Construction. Any Commercial building constructed or rehabilitated and sold, leased, advertised or otherwise held out to be a "zero energy" building or "net zero energy building" or made subject to an equivalent claim must satisfy the standards set forth in Appendix CC Zero Energy Commercial Building Provisions, in addition to any other energy efficiency and renewable energy standards that are applicable to such building. A building inspection and independent confirmation of compliance with Appendix CC must be conducted and supporting documentation must be submitted to demonstrate full compliance with Appendix CC. The building code official may require additional information, as appropriate, to demonstrate compliance.

R406.8 Zero Energy Residential Construction. Any residential building constructed or rehabilitated and sold, leased, advertised or otherwise held out to be as "zero energy" building or "net zero energy" or made subject to an equivalent claim must satisfy the standards set forth in Appendix RC Zero Energy Residential Building Provisions in addition to any other energy efficiency and renewable energy standards applicable to such construction or rehabilitation. Inspection and independent confirmation of compliance with Appendix RC must be conducted and documentation provided, consistent with the provisions of R406, R407 (including R407.1-R407.6) to confirm compliance with Appendix RC Zero Energy Residential Building Provisions. The building code official may require additional information, as appropriate, to demonstrate compliance.

N1106.8 Zero Energy Residential Construction.

Any residential building constructed or rehabilitated and sold, leased, advertised or otherwise held out to be as "zero energy" building or "net zero energy" or made subject to an equivalent claim must satisfy the standards set forth in Appendix RC Zero Energy Residential Building Provisions in addition to any other energy efficiency and renewable energy standards applicable to such construction or rehabilitation. Inspection and independent confirmation of compliance with Appendix RC must be conducted and documentation provided, consistent with the provisions of N1106, N1107 (including N1107.1-N407.6) to confirm compliance with Appendix RC Zero Energy Residential Building Provisions. The building code official may require additional information, as appropriate, to demonstrate compliance.

Reason Statement: The 2021 IECC adds two appendices specifying the requirements for "zero energy" construction: "Appendix CC Zero Energy Commercial Building Provisions" and "Appendix RC Zero Energy Residential Building Provisions".

The purpose of this proposal is to activate the standards set forth in these two appendices by making them applicable and mandatory for any buildings constructed and sold or leased as being "zero energy" or "net zero energy" or equivalent labels. It does not require builders to go beyond the generally applicable terms of the 2021 IECC, but it protects buyers, residents and competing "zero energy" builders by assuring that buildings claimed to be "zero energy" actually meet recognized "zero energy" energy conservation standards. The appendices are new and will be incorporated into Virginia's 2021 building code update.

Zero energy buildings are hugely valuable for residents and landlords because they eliminate energy costs of occupancy, over time, through a combination of enhanced energy efficiency and renewable energy. Such buildings are becoming increasingly popular, particularly since they cut both occupancy costs and pollution driving climate change. In reality, a shift to zero energy (net zero energy) housing will be critical to keeping global temperatures at levels that will prevent catastrophic climate harms. Given that new housing will operate for 70 or more years, it is vital that quality zero carbon construction begin sooner rather than later. Even though it does not mandate zero carbon construction, this proposal will at least establish minimum standards for such construction.

Resiliency Impact Statement: This proposal will increase Resiliency

This proposal will increase resiliency in several ways. Individual zero energy buildings and their occupants will be more resilient because they will (a) consume less energy, (b) produce zero-carbon renewable energy equal to or in excess of their energy needs, (c) retain heat or cooling during periods of utility outages, (d) be more capable of self-supplying energy during periods of utility outages, and (e) less exposed to economic harm from fluctuating energy prices. These are large resiliency benefits for residents in zero energy dwellings and their lenders or landlords.

This proposal will also increase resiliency for the public by reducing greenhouse gas emissions, reducing demands on utilities during critical supply and price periods and reducing risks of loan and lease defaults attributable to fluctuating energy prices.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal does not require construction of zero energy buildings. It merely assures that buildings meet basic standards of construction and truth in advertising if they are built and sold or leased as "zero energy" buildings.

FP107.11-21

VFC: 107.11, 107.12

Proponents: Joshua Davis (joshua.davis@vdfp.virginia.gov)

2018 Virginia Statewide Fire Prevention Code

Revise as follows:

107.11 State Fire Marshal's office permit fees for explosives, blasting agents, theatrical flame effects, and fireworks. Complete *permit* applications shall be submitted to and received by the *State Fire Marshal's Office* not less than 15 days prior to the planned use or event. A \$500 expedited handling fee will be assessed on all permit applications submitted less than 15 days prior to the planned use or event. Inspection fees will be assessed at a rate of ~~\$60~~ \$150 per staff member per hour during normal business hours (Monday through Friday, 8:30 a.m. to 4:30 p.m.) and at a rate of ~~\$90~~ \$225 per hour at all other times (nights, weekends, holidays). *State Fire Marshal's Office* permit fees shall be as follows:

1. Storage of *explosives* and *blasting agents*, 12-month *permit* \$250 first *magazine*, plus \$150 per each additional *magazine* on the same *site*.
2. Use of *explosives* and *blasting agents*, nonfixed *site*, 6-month *permit* \$250 per *site*, plus inspection fees.
3. Use of *explosives* and *blasting agents*, fixed *site*, 12-month *permit* \$250 per *site*.
4. Sale of *explosives* and *blasting agents*, 12-month *permit* \$250 per *site*.
5. Manufacture *explosives* (unrestricted), *blasting agents*, and *fireworks*, 12-month *permit* \$250 per *site*.
6. Manufacture *explosives* (restricted), 12-month *permit* ~~\$20~~ \$200 per *site*.
7. *Fireworks* display in or on state-owned property \$300 plus inspection fees.
8. *Pyrotechnics* or proximate audience displays in or on state-owned property \$300 plus inspection fees.
9. Flame effects in or on state-owned property \$300 plus inspection fees.
10. Flame effects incidental to a permitted *pyrotechnics* display \$150 (flame effects must be individual or group effects that are attended and manually controlled).

Exception: Permit fees shall not be required for the storage of *explosives* or *blasting agents* by state and local law enforcement and fire agencies.

107.12 State annual compliance inspection fees. Fees for compliance inspections performed by the *State Fire Marshal's office* shall be as follows:

1. Nightclubs.
 - 1.1. ~~\$350~~ \$500 for *occupant load* of 100 or less.
 - 1.2. ~~\$450~~ \$600 for *occupant load* of 101 to 200.
 - 1.3. ~~\$500~~ \$650 for *occupant load* of 201 to 300.
 - 1.4. ~~\$500~~ \$650 plus ~~\$50~~ \$100 for each 100 occupants where *occupant loads* exceed 300.
2. Private college dormitories with or without assembly areas. If containing assembly areas, such assembly areas are not included in the computation of square footage.
 - 2.1. ~~\$150~~ \$350 for 3,500 square feet (325 m²) or less.
 - 2.2. ~~\$200~~ \$400 for greater than 3,500 square feet (325 m²) up to 7000 square feet (650 m²).
 - 2.3. ~~\$250~~ \$450 for greater than 7,000 square feet (650 m²) up to 10,000 square feet (929 m²).
 - 2.4. ~~\$250~~ \$450 plus \$50 for each additional 3,000 square feet (279 m²) where square footage exceeds 10,000 square feet (929 m²).

3. Assembly areas that are part of private college dormitories.

- 3.1. ~~\$50~~ \$200 for 10,000 square feet (929 m²) or less provided the assembly area is within or attached to a dormitory *building*.
- 3.2. ~~\$100~~ \$250 for greater than 10,000 square feet (929 m²) up to 25,000 square feet (2323 m²) provided the assembly area is within or attached to a dormitory *building*, such as gymnasiums, auditoriums or cafeterias.
- 3.3. ~~\$100~~ \$250 for up to 25,000 square feet (2323 m²) provided the assembly area is in a separate or separate *buildings* such as gymnasiums, auditoriums or cafeterias.
- 3.4. ~~\$150~~ \$300 for greater than 25,000 square feet (2323 m²) for assembly areas within or attached to a dormitory *building* or in a separate or separate *buildings* such as gymnasiums, auditoriums or cafeterias.

4. Hospitals.

- 4.1. ~~\$300~~ \$450 for 1 to 50 beds.
- 4.2. ~~\$400~~ \$550 for 51 to 100 beds.
- 4.3. ~~\$500~~ \$650 for 101 to 150 beds.
- 4.4. ~~\$600~~ \$750 for 151 to 200 beds.
- 4.5. ~~\$600~~ \$750 plus ~~\$100~~ \$200 for each additional 100 beds where the number of beds exceeds 200.

5. Facilities licensed by the Virginia Department of Social Services based on licensed capacity as follows:

- 5.1. ~~\$50~~ \$200 for 1 to 8.
- 5.2. ~~\$75~~ \$225 for 9 to 20.
- 5.3. ~~\$100~~ \$250 for 21 to 50.
- 5.4. ~~\$200~~ \$350 for 51 to 100.
- 5.5. ~~\$300~~ \$450 for 101 to 150.
- 5.6. ~~\$400~~ \$550 for 151 to 200.
- 5.7. ~~\$500~~ \$650 for 201 or more.

Exception: Annual compliance inspection fees for any *building* or groups of *buildings* on the same *site* may not exceed ~~\$2500~~ \$3500.

6. Registered complaints.

- 6.1. ~~No charge for first visit (initial complaint), and if violations are found, \$150 per hour for each State Fire Marshal's Office staff during normal business hours (Monday through Friday, 8:30 a.m. to 4:30 p.m.) and at a rate of \$225 per hour at all other times (nights, weekends, and holidays).~~
- 6.2. ~~\$51 per hour for each State Fire Marshal's office staff for all subsequent visits.~~

7. *Bonfires* (small and large) on state-owned property.

- 7.1. For a small *bonfire* pile with a total fuel area more than 3 feet (914 mm) in diameter and more than 2 feet (610 mm) in height, but not more than 9 feet (2743 mm) in diameter and not more than 6 feet (1829 mm) in height, the permit fee is ~~\$50~~ \$200. If an application for a *bonfire permit* is received by the *State Fire Marshal's* office less than 15 days prior to the planned event, the permit fee shall be ~~\$100~~ \$250. If an application for a *bonfire permit* is received by the *State Fire Marshal's* office less than 7 days prior to the planned event, the permit fee shall be ~~\$150~~ \$300.
- 7.2. For a large *bonfire* pile with a total fuel area more than 9 feet (2743 mm) in diameter and more than 6 feet (1829 mm) in height, the permit fee is ~~\$150~~ \$250. If an application for a *bonfire permit* is received by the *State Fire Marshal's* office less than 15 days prior to the planned event, the permit fee shall be ~~\$300~~ \$400. If an application for a *bonfire permit* is received by the *State Fire Marshal's* office less than 7 days prior to the planned event, the permit fee shall be ~~\$450~~ \$550.

8. Additional Inspection and Permit Fees.

8.1 Mobile food preparation vehicles. \$200 Annual Operational Permit for mobile food preparation vehicles equipped with appliances that produce smoke or grease laden vapors.

Exception: Recreational vehicles used for private recreation.

8.2 Tents, Canopies and Membrane Structures. \$200 Annual Permit for any individual or adjacent tent(s), stage canopy, or air-supported structure(s) covering an area of more than 900 square feet unless used exclusively for recreational camping purposes.

8.3 Special Amusement Building Occupancies. \$200 Annual Operational Permit for any temporary or permanent amusement facilities where the means of egress is not readily apparent, is intentionally confounding, or is not readily available.

9. Hazardous Materials Processing or Storage Operational Permit Fees.

9.1 Aviation Facilities. \$200 Annual Operational Permit for Group H or Group S occupancy for aircraft servicing or repair and aircraft fuel-servicing vehicles. Additional permits required by other sections of this code include, but are not limited to, hot work, hazardous materials and flammable or combustible finishes.

9.2 Waste Handling. \$200 Annual Operational Permit for facilities conducting operations similar to wrecking yards, junk yards, and waste material handling or recycling centers.

9.3 Combustible Storage and Hazardous Operations.

9.3.1 \$200 Annual Operational Permit for facilities storing or handling more than 100 cubic feet of combustible fibers, rags, or scrap textiles.

9.3.2 \$200 Annual Operational Permit for facilities such as grain elevators, flour or feed mills, or other pulverizing processing producing combustible dust.

9.3.3 \$200 Annual Operational Permit for storage of Flammable and combustible liquids:

A. Service station or repair garage, OR

B. UST closure or temporary out of service

9.4 Flammable finishes. \$200 Annual Operational Permit for spraying or dipping operations utilizing flammable or combustible products or flammable floor refinishing operations exceeding 350 square feet in size.

9.5 High-Piled and Combustible Storage. \$200 Annual Operational Permit for facilities storing more than 500 square feet of materials in arrangements greater than 12 feet in height.

9.6 Plant Extraction Systems. \$200 Annual Operational Permit for plant oil processing and extraction systems.

9.7 Tire Storage and Rebuilding Operations. \$200 Annual Operational Permit for facilities storing more than 2,500 cubic feet of tires including scrap tires or operating tire rebuilding plants.

9.8 Welding and other Hot Work.

9.8.1 \$200 Operational Permit for facilities conducting welding, open torches, or other hot work (except where used for construction purposes)

9.8.2 \$200 Annual Operational Permit for Hot Work Program.

9.10 \$200 Annual Permit for Flammable and combustible liquids storage.

Reason Statement: The Virginia Statewide Fire Prevention Code, which is amended and adopted by the Commonwealth of Virginia Board of Housing and Community Development, and set forth in Section 27-94 et seq. the Code of Virginia, shall be enforced, including the imposition of fees to defray costs, as may be necessary for the administration and enforcement. The Virginia Statewide Fire Prevention Code sets certain procedures for the Virginia State Fire Marshal's Office's fee schedule which here in are recommended to be adjusted comparable with other localities in Virginia. The 2006 SFPC list the initial fees for the State Fire Marshal's Office and have not been adjusted for the past 15 plus years. To better serve the Commonwealth of Virginia and to defray costs, as may be necessary for the administration and enforcement.

Resiliency Impact Statement: This proposal will increase Resiliency

The mission of the State Fire Marshal's Office is to make fire safety a way of life in the Commonwealth of Virginia. We accomplish this through inspection and compliance of the Virginia Statewide Fire Prevention Code. The State Fire Marshal's Office continually strives to better serve our citizens and the communities which we are tasked with protecting. The proposed increase in fees will be critical to the future services provided by

the State Fire Marshal's Office and to better maintain safe buildings across Virginia. The demand for services from the Fire Marshal has steadily increased over the past 15 years. Therefore, the Virginia State Fire Marshal and the Director of Virginia Fire Programs propose an increase in certain fees set forth in the Virginia Statewide Fire Prevention Code, permits and fees Section 107.

Cost Impact: The code change proposal will increase the cost of construction

The proposed fees will not impact construction cost, however, they will impact those business that fall within these inspections and permits. This increase is comparable with localities around Virginia and are in line with the increase in the State Fire Marshal's Office operational budget. The fees imposed pursuant to this section shall be used to defray the cost of administration and enforcement under the Statewide Fire Prevention Code.

FP3303.3.1-21

IFC: 3303.3.1, 3305.9, 3307.2.1, 3311.1, [BE] 3312.1, 3314.1, 3314.2, 3314.3

Proponents: VFSB Codes and Standards Committee (amiliken@staffordcountyva.gov)

2021 International Fire Code

Revise as follows:

3303.3.1 Violations. ~~Failure~~ Failure to properly conduct, document and maintain documentation required by this section shall constitute an unlawful act in accordance with Section 112.1 and shall result in the issuance of a notice of violation to the site safety director in accordance with Section 112.3. Upon the third offense 111 and, the fire code official is authorized to issue a stop work order in accordance with Section 113, and work shall not resume until satisfactory assurances of future compliance have been presented to and approved by the fire code official. may request a stop work order be issued by the Building Official.

3305.9 Separations between construction areas. Separations used in Type I and Type II construction to separate construction areas from occupied portions of the building shall be maintained in accordance with the applicable building code. ~~constructed of materials that comply with one of the following:~~

- ~~1. Noncombustible materials.~~
- ~~2. Materials that exhibit a flame spread index not exceeding 25 when tested in accordance with ASTM E84 or UL 723.~~
- ~~3. Materials exhibiting a peak heat release rate not exceeding 300 kW/m² when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation on specimens at the thickness intended for use.~~

3307.2.1 Pipe cleaning and purging. The cleaning and purging of flammable gas piping systems, including cleaning new or existing piping systems, purging piping systems into service and purging piping systems out of service, shall comply with NFPA 56.

Exceptions:

1. Compressed gas piping systems other than fuel gas piping systems where in accordance with Chapter 53.
2. Piping systems regulated by the ~~International~~ Virginia Fuel Gas Code.
3. Liquefied petroleum gas systems in accordance with Chapter 61.

3311.1 Required access. Approved vehicle access for fire fighting shall be provided to all construction or demolition sites. Vehicle access shall be provided to within 100 feet (30 480 mm) of buildings and temporary or permanent fire department connections. Vehicle access shall be provided by either temporary or permanent roads, capable of supporting vehicle loading under all weather conditions. Vehicle access shall be maintained until permanent fire apparatus access roads are available.

[BE] 3312.1 Stairways required. Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be ~~provided.~~ maintained in accordance with the applicable building code. As construction progresses, such stairway shall be ~~extended to within one floor of the highest point of construction having secured decking or flooring.~~ maintained in accordance with the applicable building code.

3314.1 Where required. ~~In buildings buildings required to~~ Where required by the applicable building code, a temporary or permanent standpipe shall be maintained and remain in an operable condition so as to be available for use by the fire department. ~~to have standpipes by Section 905.3.1, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to stairways complying with Section 3312.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.~~

Delete without substitution:

3314.2 Buildings being demolished. ~~Where a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.~~

3314.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Section 905.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes comply with the requirements of Section 905 as to capacity, outlets and materials.

Reason Statement: Clean up of Chapter 33 Fire Safety During Construction to remove construction provisions and correlate better with the VCC and VEBC.

Resiliency Impact Statement: This proposal will increase Resiliency

By improving the SFPC, the resiliency of communities is increased by protecting them from the hazards associated with poor fire safety practices during construction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

No cost impact.

REC-R401.2.5-21

IECC@: R103.2.4 (New), R105.2.5 (New), R105.2.5, SECTION 202 (New), R401.2.5, R401.3, R402.1, R404.6 (New), TABLE R405.2, TABLE R406.2, TABLE R406.5, R408.2.3

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

R103.2.4 Electrification system. The construction documents shall provide details for additional electric infrastructure, including branch circuits, conduit, or pre-wiring, and panel capacity in compliance with the provisions of this code.

R105.2.5 Electrical rough-in inspection. Inspections at electrical rough-in shall verify compliance as required by the code and the approved plans and specifications as to the locations, distribution, and capacity of the electrical system.

Revise as follows:

~~R105.2.5~~ **R105.2.6 Final inspection.** The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* systems, equipment and controls and their proper operation and the required number of high-efficacy lamps and fixtures.

Add new text as follows:

ALL-ELECTRIC BUILDING. A *building* that contains no *combustion equipment*, or plumbing for *combustion equipment*, installed within the *building*, or *building site*.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

COMBUSTION EQUIPMENT. Any *equipment* or *appliance* used for space heating, *service water heating*, cooking, clothes drying, or lighting that uses *fuel gas* or *fuel oil*.

EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

FUEL GAS. A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

MIXED-FUEL BUILDING. A *building* that contains *combustion equipment* or includes piping for *combustion equipment*.

Revise as follows:

R401.2.5 Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency. ~~1. For buildings complying with Section~~

~~1.~~ For *all-electric buildings* complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.

~~2.~~

2. For

~~buildings complying under with Section~~

mixed-fuel buildings complying with Section R401.2.1, the building shall be required to install either R408.2.1 or R408.2.5 of the additional efficiency package options, and any two of R408.2.2, R408.2.3, or R408.2.4 of the additional efficiency package options.

3. For buildings complying with Section R401.2.2, the building shall meet one of the following:

~~2.1. One~~

23.1. *All-electric buildings* shall have ~~one~~ one of the additional efficiency package

~~Options in Section R408.2 shall be~~

options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or

23.2. The proposed design of the *all-electric building* building under Section R405.3 shall have an annual energy cost that is less than or equal to the

95 percent of the annual energy cost of the standard reference design.; or

3.3 Mixed-fuel buildings shall have either R408.2.1 or R408.2.5 of the additional efficiency package options, and any two of R408.2.2, R408.2.3, or R408.2.4 of the additional efficiency package options installed without including such measures in the proposed design under Section R405; or

2.2.

3.4 The proposed design of the

building under Section R405.3 shall

mixed-fuel building under Section R405.3 shall have an annual energy cost that is less than or equal to

95

85 percent of the annual energy cost of the standard reference design.

3. For 3.4. For buildings complying with the complying with the the Energy Rating Index alternative Section R401.2.3, the Energy Rating

Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.

The option selected for compliance shall be identified in the certificate required by Section R401.3.

R401.3 Certificate. A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

~~sizes and sizes and~~

1.

2.

3.

4.

sizes, fuel sources, and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furn

5.

6.

7.

8.

R402.1 General. The *building thermal envelope* shall comply with the requirements of Sections R402.1.1 through R402.1.5.

Exceptions:

Those that

1.

The following low-energy *buildings*, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from the *building thermal envelope* provisions of Section R402.

1.1. Those containing no combustion equipment with a peak design rate of energy usage less than 3.4 Btu/h × ft² (10.7 W/m²) or 1.0 watt/ft² of floor area for space-conditioning purposes.

1.2.

Those containing no combustion equipment that do not contain conditioned space.

2.

Log homes designed in accordance with ICC 400.

Add new text as follows:

R404.6 Additional electric infrastructure. *Combustion equipment* shall be installed in accordance with this section.

R404.6.1 Equipment serving multiple units. *Combustion equipment* that serves multiple *dwelling units* shall comply with Section C405.16.

R404.6.2 Combustion water heating. Water heaters shall be installed in accordance with the following:

1. A dedicated 240-volt branch circuit with a minimum capacity of 30 amps shall terminate within 3 feet (914 mm) from the water heater and be

accessible to the water heater with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Heat Pump Water Heater" and be electrically isolated.

2. A condensate drain that is no more than 2 inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within 3 feet (914 mm) of the water heater.

3. The water heater shall be installed in a space with minimum dimensions of 3 feet (914 mm) by 3 feet (914 mm) by 7 feet (2134 mm) high.

4. The water heater shall be installed in a space with a minimum volume of 700 cubic feet (20,000 L) or the equivalent of one 16-inch (406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203 mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.

R404.6.3 Combustion space heating. Where a building has combustion equipment for space heating, the building shall be provided with a designated exterior location(s) in accordance with the following:

1. Natural drainage for condensate from cooling equipment operation or a condensate drain located within 3 feet (914 mm), and

2. A dedicated branch circuit in compliance with IRC Section E3702.11 based on heat pump space heating equipment sized in accordance with R403.7 and terminating within 3 feet (914 mm) of the location with no obstructions. Both ends of the branch circuit shall be labeled "For Future Heat Pump Space Heater."

Exception: Where an electrical circuit in compliance with IRC Section E3702.11 exists for space cooling equipment.

R404.6.4 Combustion clothes drying. A dedicated 240-volt branch circuit with a minimum capacity of 30 amps shall terminate within 6 feet (1829 mm) of natural gas clothes dryers and shall be accessible with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Electric Clothes Drying" and be electrically isolated.

R404.6.5 Combustion cooking. A dedicated 240-Volt, 40A branch circuit shall terminate within 6 feet (1829 mm) of natural gas ranges, cooktops and ovens and be accessible with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Electric Range" and be electrically isolated.

R404.6.6 Other combustion equipment. Combustion equipment and end-uses not covered by Sections R404.6.2-5 shall be provided with a branch circuit sized for an electric *appliance*, *equipment* or end use with an equivalent capacity that terminates within 6 feet (1829 mm) of the *appliance* or *equipment*.

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION^a	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation installations
R402.4.1.1	Installation
R402.4.1.2	Testing
R402.5	Maximum fenestration U-factor and SHGC
Mechanical	
R403.1	Controls
R403.3, including R403.3.1, except Sections R403.3.2, R403.3.3 and R403.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
404.2	Interior lighting controls
<u>R404.6</u>	<u>Additional electric infrastructure</u>

a. Reference to a code section includes all the relative subsections except as indicated in the table.

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION ^a	TITLE
General	
R401.2.5	Additional efficiency packages
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation installation
R402.4.1.1	Installation
R402.4.1.2	Testing
Mechanical	
R403.1	Controls
R403.3 except Sections R403.3.2, R403.3.3 and R403.3.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water calculation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
404.2	Interior lighting controls
<u>R404.6</u>	<u>Additional electric infrastructure</u>
R406.3	Building thermal envelope

a. Reference to a code section includes all of the relative subsections except as indicated in the table.

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX-All-Electric Building	Mixed Fuel Building
0-1	52	<u>52</u>
2	52	<u>52</u>
3	51	<u>51</u>
4	54	<u>54</u>
5	55	<u>47</u>
6	54	<u>46</u>
7	53	<u>46</u>
8	53	<u>53</u>

R408.2.3 Reduced energy use in service water-heating option. The hot water system shall meet one of the following efficiencies:

1. Greater than or equal to 82 EF fossil fuel service water-heating system.
2. Greater than or equal to 2.0 EF electric service water-heating system.
3. Greater than or equal to 0.4 solar fraction solar water-heating system.
4. Greater than or equal to 82 EF instantaneous fossil fuel service water-heating system and drain water heat recovery unit meeting the requirements of Section R403.5.3 installed on at least one shower.

Reason Statement: In order to meet the state’s 2045 carbon neutrality goal, Virginia must not only reduce energy use through energy efficiency and move to utility scale and on-site renewable energy, but also begin to transition away from using combustion equipment in buildings that runs on fossil fuels to electric equipment. Therefore it is crucial that new buildings today can be cost-effectively retrofitted in the future with electric equipment so that emissions are not “locked-in” by gas-dependent building infrastructure. Fortunately, heat pump technology has dramatically improved over the last few decades, giving contractors and building owners access to highly efficient electric heating and cooling, and water heating technologies.

One of the biggest expenses of electrification retrofits – and therefore barriers to electrification in existing buildings - is running electrical infrastructure through a completed and enclosed building that has combustion equipment. This significant future cost can be greatly reduced through making simple, low-cost modifications to buildings during construction that enable easier electrification in the future. The requirements in this proposed amendment ensure that the electrical infrastructure is in place so that building owners can convert to an all-electric building in the future and ensures that unitized gas water heaters can be replaced with high-performance heat pump water heaters (HPWHs). Because all-electric buildings are more efficient than mixed-fuel buildings, this code amendment also requires buildings with combustion equipment to be as or more efficient than all-electric buildings.

Electric Infrastructure:

The addition of R404.6 ensures the electrical plugs and physical space exists so that a building owner can cost effectively replace their gas equipment and appliances with electric equipment in the future. This language is based on the approach adopted in the electrification reach codes adopted by various California cities.

As described in R404.6.1, this proposal is limited to gas equipment that serves individual dwelling units. Equipment that serves multiple dwelling units is directed to a similar proposed code amendment in the commercial section. If LARA choses to adopt this amendment and not the electric-readiness amendment for commercial, this amendment should be revised accordingly.

R404.6.2 is focused on ensuring that water heater locations are physically capable of incorporating a future heat pump water heater (HPWH). Requirement 1 ensures that there is a branch circuit ready to support the future installation of a HPWH. Requirement 2 ensures that the condensate generated by a HPWH compressor can be easily drained away. Requirement 3 ensures that the water heater location is physically large enough to accommodate HPWHs that are frequently wider and/or taller than code-minimum gas water heaters. Requirement 4 ensures that a future HPWH has access to sufficient air volume to effectively operate. These requirements are based on the requirements adopted in several CA jurisdictions electrification reach codes.

R404.6.3 ensures the electric infrastructure for combustion space heating is present so that a heat pump can be installed in the future. The section references IRC Section E3702.11 which sets the requirement for sizing a branch circuit serving a heat pump and relies on the size of the actual equipment to be installed. Since there is not an actual equipment size to reference and equipment size can vary depending on the size of the home and the climate, the section also references Section R403.7 to establish the size of the heat pump equipment that would be required for the specific home.

R404.6.4 and R404.6.5 requires combustion clothes drying and cooking to have plugs nearby so that a homeowners can replace them with electric equipment cost effectively in the future. IRC Section E3702.9.1 requires a 240V/40A branch circuit for a standard 8.75 kVA or larger electric

residential range and has been used as the basis for the sizing of the branch circuit. Six feet is cited per requirements from IRC Section E3901.5 requiring appliance receptacles to be within 6 feet of the intended appliance.

This section and others rely on new definitions for appliance, equipment, fuel gas and fuel oil which are mirrored from 2021 IMC to be useful in defining combustion equipment.

Inspection, Construction Documents and Efficiency

R401.3 requires builders to note the electric infrastructure in place on the compliance certificate to both allow for easier enforcement of these provisions and to ensure current or future homeowners are aware that they can easily replace combustion equipment and appliances with electric equipment and appliances.

Because all-electric newly constructed homes typically use less energy when compared to newly constructed mixed-fuel homes. Revisions to R401.2.5 seeks to encourage electrification and more evenly weigh the impact of the additional efficiency credits by requiring the mixed-fuel home to select a total of three packages from the options while the all-electric home is required to select one package. Of the three packages required for the mixed-fuel home, one must address the envelope (improved envelope or reduced infiltration plus better ventilation) while the remaining two impact HVAC (better equipment or more efficient ducts) and water-heating (better equipment) requirements). Since mixed fuel buildings will be required to select more package options, the amendment also adds a fourth service hot water package that combines the efficiency benefits of an instantaneous gas water heater with a drain water heat recovery unit. This package is based on analysis conducted by the Northwest Energy Efficiency Alliance^[1] (NEEA). Modifications to requirement 3 under R401.2.4 applies this same concept to the performance path.

Low-energy buildings

Low energy buildings are currently exempt from thermal envelope requirements. The revision to R402.1 requires low-energy buildings that choose not to install insulation to be all-electric to reduce their greenhouse gas impact.

ERI and Performance Pathway

The proposal also includes a modification to the mandatory table in R405 and R406 to ensure that projects using the ERI or performance method will also comply with electric-readiness requirements. An additional modification to R406 encourages homes following the ERI performance path to be all-electric by setting more stringent ERI values for mixed-fuel homes. This is needed as Standard 301, which sets the calculation methodology for calculating ERI, claims to be fuel agnostic. The ERI values for mixed-fuel homes match those from ASHRAE 90.2 and Appendix RC Zero Energy Residential Building Provisions as published in the 2021 IECC. The ERI values for all-electric homes are the same as the values published in Table R406.5 of the 2021 IECC.

Resiliency Impact Statement: This proposal will increase Resiliency

Electric ready infrastructure allows single-family and small multifamily homes the ability to take advantage of the greening grid while spreading out the costs. As noted in the reason statement, they will likely transition from fossil fuel to electric appliances over their lifespan. Although these buildings will require more electricity from the grid than their fossil fuel burning counterparts as they transition, they will be able to operate entirely on clean renewable energy.

By constructing electric-ready, homeowners will additionally be given the tools they need to make decisions on the timing to switch fuel sources. As the costs of fuels change over time, owners will be ready to remove themselves from the volatility and geopolitics of the fossil fuel market.

Cost Impact: The code change proposal will increase the cost of construction

Virginia buildings that are all-electric would have no change in construction costs. Mixed fuel buildings would be slightly more expensive to build because they would both have to be electric-ready and be more efficient. Electric-ready requirements are anticipated to be nominal. Recent analysis by NBI and partners using cost data from RSMMeans indicates that additional electrical infrastructure costs for water-heating, space-heating, and cooking cost \$440. Cost data from Grainger indicates additional energy efficiency measures required by mixed-fuel buildings would raise construction costs by \$1,350.

However if a homeowner were to have to retrofit their home from using combustion equipment to natural gas equipment costs without these requirements in place, costs could be exorbitant. For example, upgrading the electrical panel could cost upwards of \$6,000 if it is not sized appropriately.

REC-R401.2-21

IECC®: SECTION 202 (New), CHAPTER 4 [RE], R401.2, R401.3, R402.4.4, R404.1.2, R408.2.2, R408.2.3

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

ALL-ELECTRIC BUILDING. A building that contains no combustion equipment, or plumbing for combustion equipment, installed within the building, or building site.

Revise as follows:

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

Add new text as follows:

COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, service water heating, cooking, clothes drying, or lighting that uses fuel gas or fuel oil

EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

Revise as follows:

R401.2 Application. Residential ~~buildings shall~~ buildings shall be *all-electric buildings* and shall comply with Section ~~R401.2.5~~ R401.2.4 and either Sections R401.2.1, R401.2.2, ~~R401.2.3 or R401.2.4~~, or R401.2.3.

Exception: Additions, *alterations*, repairs and changes of occupancy to existing buildings complying with Chapter 5.

R401.3 Certificate. A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

~~a gas-fired unvented room heater, "gas-fired unvented room heater," gas-fired unvented room heaters,~~

1.

The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls, crawl space walls* and floors and ducts outside *conditioned spaces*.

2.

U-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.

3.

The results from any required duct system and building envelope air leakage testing performed on the building.

4.

The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where

a electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for electric furnaces and electric baseboard heaters.

- | | |
|----|--|
| 5. | Where on-site <i>photovoltaic panel</i> systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate. |
| 6. | For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate. |
| 7. | The code edition under which the structure was permitted and the compliance path used. |

Delete without substitution:

R402.4.4 Rooms containing fuel-burning appliances. In Climate Zones 3 through 8, where open combustion air ducts provide combustion air to open combustion fuel-burning appliances, the appliances and combustion air opening shall be located outside the *building thermal envelope* or enclosed in a room that is isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table R402.1.3, where the walls, floors and ceilings shall meet a minimum of the *basement wall R*-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section R403. The combustion air duct shall be insulated where it passes through *conditioned space* to an *R*-value of not less than R-8.

Exceptions:

- 1- Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
- 2- Fireplaces and stoves complying with Section R402.4.2 and Section R1006 of the International Residential Code.

Revise as follows:

R404.1.2 Fuel gas lighting equipment. Fuel gas lighting systems shall not ~~be installed.~~ ~~have continuously burning pilot lights.~~

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies:

- ~~1. 95 AFUE natural gas furnace and 16 SEER air conditioner. Greater than or equal to~~
- 1. Greater than or equal to
- ~~2.~~
- 10 HSPF/16 SEER air source heat pump.
- ~~3.~~
- 2. Greater than or equal to 3.5 COP ground source heat pump.

For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

R408.2.3 Reduced energy use in service water-heating option. The hot water system shall meet one of the following efficiencies:

- ~~1. 82 EF fossil fuel service water heating system. Greater than or equal to~~
- 1. Greater than or equal to
- ~~2.~~
- 2.0 EF electric service water-heating system.
- ~~3.~~
- 2. Greater than or equal to 0.4 solar fraction solar water-heating system.

Reason Statement: In order to meet the state’s 2045 carbon neutrality goal, Virginia must not only reduce energy use through energy efficiency and move to utility scale and on-site renewable energy, but also begin to transition away from using combustion equipment in buildings that runs on fossil fuels to electric equipment.

In 2020, combustion equipment in commercial and residential buildings accounted for 36% of the United States energy-related greenhouse gas emissions. . To meet Virginia’s goal, it is crucial that new homes built today are all-electric so that emissions from these buildings are not “locked-in” by gas-dependent building infrastructure.

Fortunately, heat pump technology has dramatically improved over the last few decades, giving contractors and building owners access to highly efficient electric heating and cooling, and water heating technologies. An Ecotope study of the 2017 Oregon Residential code found that homes heated by electric heat pumps use 40 percent less energy than homes heated with gas (including water heating). Even accounting for reduced efficiency in extreme cold weather, according to a study by RMI, modern air source heat pumps are more than twice as efficient as gas furnaces and can save families up to 14 percent on their utility bills in Climate Zone 5. This is one reason why the U.S. EPA just announced that standards for the most efficient appliances in 2022 certified under the ENERGY STAR program will be all-electric.

All-electric homes are also healthier homes. Gas appliances release harmful pollutants like nitrogen dioxide (NO2) and carbon monoxide (CO) either indoors because of gas stoves or outdoors because of space-heating and water heating equipment. A recent study from the Harvard Chang School

of Public Health and RMI shows that in 2017, air pollution from burning fuels in buildings led to an estimated 48,000 to 64,000 early deaths and \$615 billion in health impact costs. These emissions can particularly affect children. In a meta-analysis analyzing the connections between gas stoves and childhood asthma, children in homes with gas stoves were 42% more likely to experience asthma symptoms, and 32% more likely to be diagnosed with asthma.

All-electric new construction is also less expensive to build than a home with gas appliances and in the long term will result in fewer retrofit costs for homeowners to meet future policy goals to eliminate all carbon emissions in the U.S. by 2050.

Therefore, building all-electric buildings is critical to reducing air pollution, protecting public health, reducing utility and construction costs, and meeting climate goals. NBI is submitting this amendment along with amendments that address on-site renewables, electric vehicles, and grid integration techniques. These proposed changes to the 2021 IECC, working together, will put the U.S. on the path to a decarbonized, resilient, and healthier future.

Resiliency Impact Statement: This proposal will increase Resiliency

As the grid becomes increasingly cleaner, all electric buildings will become less carbon intense as they age, unlike buildings with fossil fuel combustion, lessening their impact on climate change. Although these buildings will require more total electricity from the grid than their fossil fuel burning counterparts, they will be able to operate entirely on clean renewable energy.

All-electric single-family and low-rise multifamily homes additionally support better indoor air quality. Better indoor air quality is directly linked to better health of residents, including reduction of respiratory and chronic illnesses. This is especially important in homes. The reductions of these types of illnesses increase overall resilience of individuals within our communities, making them less susceptible to the impacts of extreme heat and cold, reducing medical bills, and improving overall quality of life.

Finally, these buildings will also be less dependent on the geopolitics of the fossil fuel market, leveling out energy costs during periods of disruption.

Cost Impact: The code change proposal will decrease the cost of construction

Electric appliances and equipment cost less than gas appliances. Installing all-electric appliances also reduces natural gas infrastructure costs such as gas mains, services and meters. Using data from RSMeans, Grainger, Home Depot, NBI estimates that an all-electric home costs \$8,735 less than a home built with natural gas appliances and equipment. A recent analysis by RMI which examined the cost effectiveness of all-electric homes in seven cities across the country from Climate Zone 2A to 6A, found that installing efficient heat pumps in water heating and space-heating compared to standard equipment installed in a mixed-fuel home resulted in life cycle cost savings in every city. Including the cost of more efficient electric equipment, the all-electric home cost on average \$2,700 less than a code compliant mixed-fuel home. All-electric homes with efficient heat pumps exhibited on average \$107 in lower annual utility costs. The analysis concluded that a homeowner with an all-electric home would save \$3,700 over a 15-year analysis period. In addition, all electric homes with efficient heat pumps resulted in carbon emissions savings of between fifty to ninety-three percent in all climate zones. Accounting for the societal benefit carbon emissions would result in increased life cycle cost savings across all climate zones.

Finally, neither analysis cited includes the cost of electrical retrofits that will be required of homes that are not all-electric to meet future policy goals of achieving net zero carbon emissions by 2050. Simply upgrading the electrical panel itself to add electrical capacity for new electric appliances can cost a homeowner between \$2,650 to \$4,500. Adding electrical outlets that can service major appliances so that homeowners can replace a natural gas appliance with an all-electric appliance will also add significant additional costs especially if those appliances are in areas where dry wall must be removed and repaired.

REC-R402.1.2 (1)-21

VECC: TABLE R402.1.2, TABLE R402.1.4; VRC: TABLE N1102.1.2 (R402.1.2), TABLE N1102.1.4 (R402.1.4); VCC: 1301.1.1.1, TABLE R402.1.2, TABLE R402.1.4

Proponents: Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

2018 Virginia Energy Conservation Code

Revise as follows:

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT ^a

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b,e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^c WALL R VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.30	0.55	0.25	38	20 or 13 + 5 ci or 0 + 15ci ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	30 or 20 + 5ci or 13 + 10ci or 0 + 20ci 15 or 13+1 ^h	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	30 or 20 + 5ci or 13 + 5 ci or 0 + 20ci ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required.

For SI: 1 foot = 304.8 mm.

- a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

- c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall.
"15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

TABLE R402.1.4 EQUIVALENT U-FACTORS ^a

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.32	0.55	0.026	0.079 <u>0.45</u>	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060 <u>0.45</u>	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

2018 Virginia Residential Code

Revise as follows:

TABLE N1102.1.2 (R402.1.2) INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b,e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^c WALL R-VALUE
1	NR	0.75	0.25	30	13	¾	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13 + 5ci ^h or 0 + 15ci	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	30 or 20 + 5ci or 13 + 10ci or 0 + 20ci 15 or 13 + 1 ^h	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	30 or 20 + 5ci or 13 + 10ci or 0 + 20ci ^{5h}	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20 + 5 ^h or 13 + 10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5 ^h or 13 + 10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

NR = Not Required.

- a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.
- b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

- c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation on the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation shall not be required in warm-humid locations as defined by Figure N1101.7 and Table N1101.7.
- g. Alternatively, insulation sufficient to fill the framing cavity providing not less than an *R*-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section N1102.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

TABLE N1102.1.4 (R402.1.4) EQUIVALENT U-FACTORS^a

CLIMATE ZONE	FENESTRATION U- FACTOR	SKYLIGHT U- FACTOR	CEILING U- FACTOR	FRAME WALL U- FACTOR	MASS WALL U- FACTOR ^b	FLOOR U- FACTOR	BASEMENT WALL U- FACTOR	CRAWL SPACE WALL U- FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.32	0.55	0.026	0.079 0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060 0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section N1102.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In warm-humid locations as defined by Figure N1101.7 and Table N1101.7, the basement wall *U*-factor shall not exceed 0.360.

2018 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the International Energy Conservation Code (IECC). The following changes shall be made to the IECC:

1. Add Sections C402.1.4.2, C402.1.4.2.1, C402.1.4.2.2, C402.1.4.2.3, C402.2.1.2, C402.2.1.3, C402.2.1.4, C402.2.1.5 and Change Section C402.2.1.1 to read:

C402.1.4.2 Roof/ceiling assembly. The maximum roof/ceiling assembly *U*-factor shall not exceed that specified in Table C402.1.4 based on *construction* materials used in the roof/ceiling assembly.

C402.1.4.2.1 Tapered, above-deck insulation based on thickness. Where used as a component of a maximum roof/ceiling assembly *U*-factor calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) for *U*-factor compliance as prescribed in Section C402.1.4.

C402.1.4.2.2 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly *U*-factor of the roof/ceiling *construction*.

C402.1.4.2.3 Multiple layers and staggered joints. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the *roof deck* at a gutter edge, roof drain or scupper.

C402.2.1 Roof assembly The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on *construction* materials used in the *roof assembly*.

C402.2.1.1 Tapered, above-deck insulation based on thickness. Where used as a component of a roof/ceiling assembly *R*-value calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value per inch (per mm) for *R*-value compliance as prescribed in Section C402.1.3.

C402.2.1.2 Minimum thickness, lowest point. The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be no less than 1 inch (25 mm).

C402.2.1.3 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (*R*-value) of roof insulation in roof/ceiling *construction*.

C402.2.1.4 Multiple layers and staggered joints. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the *roof deck* at a gutter edge, roof drain or scupper.

C402.2.1.5 Skylight curbs. Skylight curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-5, whichever is less.

Exception: Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

2. Change the SHGC for Climate Zone 4 (Except Marine) of Table C402.4 to read:

3. Delete Section C402.4.1.2, change Sections C402.4.2, C402.4.2.1, C402.4.2.2 and C402.4.3.

C402.4.2 Skylight area with daylight response controls. The skylight area shall be permitted to be not more than 5 percent of the roof area provided daylight responsive controls complying with Section C405.2.3.1 are installed in daylight zones under skylights.

C402.4.2.1 Daylight Zone Controls under skylights. Daylight responsive controls complying with Section C405.2.3.1 shall be provided to control all electric lights within daylight zones under skylights.

C402.4.2.2 Haze factor. Skylights that are installed in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing material or diffuser with a haze factor greater than 90 percent when tested in accordance with ASTM D1003.

Exception: Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles or the geometry of skylight and light well.

C402.4.3 Maximum U-factor and SHGC. The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

PF = A/B

(Equation 4-5)

Where different windows or glass doors have different PF values, they shall each be evaluated separately.

Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.20, the required maximum SHGC from Table C402.4 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table C402.4.3 corresponding with the orientation of the fenestration product and the projection factor.
where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the farthest continuous extremity of any overhand, eave, or permanently attached shading device to the vertical surface of the glazing.

B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

4. Add Table C402.4.3 to read:
5. Add an exception to the first paragraph of Section 403.7.7 to read:

Exception: Any grease duct serving a Type I hood installed in accordance with the *International Mechanical Code* (IMC) Section 506.3 shall not be required to have a motorized or gravity damper.

6. Add Section C403.2.2.1 to read:

C403.2.2.1 Dwelling unit mechanical ventilation. Mechanical ventilation shall be provided for *dwelling units* in accordance with the IMC.

7. Delete Section C403.7.5 and Table C403.7.5.
8. Delete Sections C404.5 through C404.5.2.1, including Tables.
9. Change Section C405.4 to read:

C405.4 Exterior lighting (Mandatory). All exterior lighting, other than low-voltage landscape lighting, shall comply with Section C405.4.1.

Exception: Where *approved* because of historical, safety, signage, or emergency considerations.

10. Change Section C502.1 to read:

C502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of Section 805 of the *Virginia Existing Building Code* (VEBC).

11. Delete Sections C502.2 through C502.2.6.2.

12. Change Section C503.1 to read:

C503.1 General. Alterations to any *building* or *structure* shall comply with the requirements of Chapter 6 of the VEBC.

13. Delete Sections C503.2 through C503.6.

14. Change Section C504.1 to read:

C504.1 General. *Buildings* and *structures*, and parts thereof, shall be repaired in compliance with Section 510 of the VEBC.

15. Delete Section C504.2.

16. Change Section R401.2 to read:

R401.2 Compliance. Projects shall comply with all provisions of Chapter 4 labeled "Mandatory" and one of the following:

1. Sections R401 through R404.
2. Section R405.
3. Section R406.
4. The most recent version of REScheck, keyed to the 2018 IECC.

17. Change Section R401.3 to read:

R401.3 A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. Where *approved*, certificates for multifamily *dwelling units* shall be permitted to be located off-site at an identified location. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, basement walls, crawl space walls and floors, and ducts outside conditioned spaces; *U*-factors of fenestration and the solar heat gain coefficient (SHGC) of fenestration; and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling, and service water heating *equipment*. Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace," or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces, and electric baseboard heaters.

~~18. Change the wood frame wall *R*-value categories for Climate Zone 4 (Except Marine) in Table R402.1.2 to read:~~

~~19. Change the frame wall *U*-factor categories for Climate Zone 4 (Except Marine) in Table R402.1.4 to read:~~

20. Change Section R402.2.4 to read:

R402.2.4 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., *attics* and crawl spaces) shall be weatherstripped and insulated in accordance with the following values:

1. Hinged vertical doors shall have a minimum overall R-5 insulation value;
2. Hatches and scuttle hole covers shall be insulated to a level equivalent to the insulation on the surrounding surfaces; and
3. Pull down stairs shall have a minimum of 75 percent of the panel area having R-5 rigid insulation.

Access shall be provided to all *equipment* that prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened and to provide a permanent means of maintaining the installed *R*-value of the loose fill insulation.

21. Change Sections R402.4 and R402.4.1.1 to read:

R402.4 Air leakage. The *building* thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1.1 Installation (Mandatory). The components of the *building* thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of *construction*. Where required by the code official, an *approved* third party shall inspect all components and verify compliance.

22. Change the title of the "Insulation Installation Criteria" category of Table R402.4.1.1; change the "Shower/tub on exterior wall" category of Table R402.4.1.1, and add footnotes "b" and "c" to Table R402.4.1.1 to read:

23. Change Section R402.4.1.2 to read:

R402.4.1.2 Testing. The *building* or *dwelling unit* shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in Climate Zone 4. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779, or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). A written report of the results of the test shall be signed by the party conducting the test and provided to the *building official*. Testing shall be conducted by a Virginia licensed general contractor, a Virginia licensed HVAC contractor, a Virginia licensed home inspector, a Virginia *registered design professional*, a certified BPI Envelope Professional, a certified HERS rater, or a certified duct and envelope tightness rater. The party conducting the test shall have been trained on the *equipment* used to perform the test. Testing shall be performed at any time after creation of all penetrations of the *building* thermal envelope.

Note: Should additional sealing be required as a result of the test, consideration may be given to the issuance of a temporary certificate of occupancy in accordance with Section 116.1.1.

During testing:

1. Exterior windows and doors and *fireplace* and stove doors shall be closed, but not sealed beyond the intended weatherstripping or other infiltration control measures;
2. Dampers, including exhaust, intake, makeup air, backdraft, and flue dampers, shall be closed, but not sealed beyond intended infiltration control measures;
3. Interior doors, if installed at the time of the test, shall be open;
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

24. Change Section R403.3.3 to read:

R403.3.3 Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exception: A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.

A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. The licensed mechanical contractor installing the mechanical system shall be permitted to perform the duct testing. The contractor shall have been trained on the equipment used to perform the test.

25. Delete Section R403.3.5.

26. Change Section R403.7 to read:

R403.7 Equipment and appliance sizing. Heating and cooling equipment and appliances shall be sized in accordance with ACCA Manual S or other *approved* sizing methodologies based on *building* loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies.

Exception: Heating and cooling equipment and appliance sizing shall not be limited to the capacities determined in accordance with Manual S or other *approved* sizing methodologies where any of the following conditions apply:

1. The specified equipment or appliance utilizes multistage technology or variable refrigerant flow technology and the loads calculated in accordance with the *approved* heating and cooling methodology fall within the range of the manufacturer's published capacities for that equipment or appliance.
2. The specified equipment or appliance manufacturer's published capacities cannot satisfy both the total and sensible heat gains calculated in accordance with the *approved* heating and cooling methodology and the next larger standard size unit is specified.
3. The specified equipment or appliance is the lowest capacity unit available from the specified manufacturer.

27. Change footnote "a" in Table R406.4 to read:

- a. When onsite renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2 and the building thermal envelope shall be greater than or equal to levels of energy efficiency and solar heat gain coefficient in Table R402.1.2, with a ceiling *R*-value of 49 and a wood frame wall *R*-value of 20 or 13 + 5, or Table R402.1.4, with a ceiling *U*-factor of 0.026 and a frame wall *U*-factor of 0.060.

28. Change Section R501.1 to read:

R501.1 Scope. The provisions of the *Virginia Existing Building Code* (VEBC) shall control the alteration, repair, addition and change of occupancy of existing *buildings* and *structures*.

29. Delete Sections R501.1.1 through R501.6.

30. Change Section R502.1 to read:

R502.1 General. Additions to an existing *building*, *building* system or portion thereof shall conform to the provisions of Section 811 of the VEBC.

31. Delete Sections R502.1.1 through R502.1.2.

32. Change Section R503.1 to read:

R503.1 General. Alterations to any *building* or *structure* shall comply with the requirements of Chapter 6 of the VEBC.

33. Delete Sections R503.1.1 through R503.2

34. Change Section R504.1 to read:

R504.1 General. *Buildings*, structures and parts thereof shall be repaired in compliance with Section 510 of the VEBC.

35. Delete Section R504.2.

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a

CLIMATE ZONE	WOOD FRAME WALL R-VALUE
4 except Marine	15 or 13 + 1 ^b

TABLE R402.1.4 EQUIVALENT U-FACTORS*

CLIMATE ZONE	FRAME WALL U-FACTOR
4 except Marine	0.079

Reason Statement: This proposal improves the comfort, efficiency, and resiliency of Virginia homes by improving the wall insulation requirements. It will also make Virginia’s energy code consistent with the 2021 IECC requirements for wall insulation. The U.S. DOE found the 2021 IECC to be cost-effective for Virginia (see https://www.energycodes.gov/sites/default/files/2021-07/VirginiaResidentialCostEffectiveness_2021.pdf), and improvements to the thermal building envelope are important to the long-term efficiency and cost-effectiveness of new buildings. Using the U.S. Department of Energy methodology for reviewing code change proposals, and using BEopt modeling software, our analysis found that an improvement from R-15 to R-20+5 in wall insulation will result in a 13.1% improvement in efficiency, and a simple payback period of less than 5 years. Wall insulation is easiest (and most cost-effective) to install during construction. Given that there may only be limited opportunities to upgrade the walls in the future, it is important to construct well-insulated walls from the very beginning. Better-insulated buildings are clearly an investment in Virginia’s energy future. We recommend maintaining consistency with the 2021 IECC requirements.

The wall insulation R-values in the 2021 IECC do not require the use of any specific product and can be achieved with either 2X4 or 2X6 wall construction. The values in the prescriptive R-value table are only a few of many different options. For additional wall insulation options, builders can use one of several compliance paths, each of which provides multiple options and combinations for meeting the code requirements:

- The U-factor alternative table (R402.1.2)
- The Total UA Alternative (R402.1.5)
- U.S. DOE’s REScheck software (www.energycodes.gov)
- The Simulated Performance Alternative (R405)
- The Energy Rating Index (R406)

This proposal also updates the equivalent U-factors to be consistent with the 2021 IRC/IECC, which is important for builders and design professionals who intend to use DOE’s free REScheck compliance software or other energy rating programs. We recommend that Virginia adopt equivalent U-factor values that will be consistent with the latest version of the IECC, both to maximize cost-effective energy efficiency and to improve the resiliency of every new home built in the Commonwealth.

Resiliency Impact Statement: This proposal will increase Resiliency

This proposal will increase resiliency in Virginia’s residential buildings. The International Code Council published a white paper titled *The Important Role of Energy Codes in Achieving Resilience* regarding the role of energy efficiency in resiliency. See https://www.iccsafe.org/wp-content/uploads/19-18078_GR_ANCR_IECC_Resilience_White_Paper_BRO_Final_midres.pdf. Specifically, the ICC found that increased insulation requirements support passive survivability and reduce energy burdens on low-income families, grid impacts by reducing energy demand, ice-dams, and condensation, limiting mold and mildew.

Cost Impact: The code change proposal will increase the cost of construction

The improvement in wall insulation will increase initial construction cost, but is clearly cost-effective to the homeowner. Using the U.S. Department of Energy methodology for evaluating code change proposals, and using BEopt modeling software, we estimated that the average incremental increase in cost for climate zone 4 is \$735.00. The average improvement in energy cost savings is 13.1%, which means simple payback is achieved within 4.4 years, on average. Obviously, results will vary based on which compliance option is selected by the builder, unique characteristics of each building, and so on. But given that walls are unlikely to be altered over the expected 70-100 year useful lifetime of the building, wall insulation is a vitally important measure to incorporate at the time of construction.

REC-R402.2-21

VECC: R202 (New), R402.2 (N1104.2) (New), R404.2.1 (N1104.2.1) (New), R404.2.2 (N1104.2.2) (New), R404.2.3 (N1104.2.3) (New), Table R404.2.2 (New), N202 (New), N1104.2 (New), N1104.2.1 (New), N1104.2.2 (New), N1104.2.3 (New), Table N1104.2.2 (New), SECTION C202 (New), C405.10 . (New), C405.10.1 (New), Table C405.10,1 (New)

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

R202 General Definitions. SECTION R202 GENERAL DEFINITIONS

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, electric motorcycles and the like, which is primarily powered by an electric motor that draws current from a rechargeable storage battery. A “plug-in hybrid” is a type of electric vehicle which relies on a combination of a rechargeable storage battery and another source of motive power.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or charging apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. A designated parking space which is provided with electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for EVSE, and with an adequately-sized raceway from the panel to a clearly identified location within three feet of the parking space, to support future EVSE.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit and adequate electric panel capacity and space to electrify EVSE. The circuit shall terminate in a suitable termination point, such as a receptacle, junction box, or an EVSE, located within three feet of the parking space.

R402.2 (N1104.2) Electric Vehicle (EV) charging for new residential construction. . New construction shall provide and facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70). **Exception:** EV supportive spaces are not required where no parking spaces are provided to residents.

R404.2.1 (N1104.2.1) One- and two-family dwellings and townhouses. . .

For each dwelling unit, provide at least one EV Ready Space in a garage or outdoor parking area. The branch circuit shall be identified as “EV Ready” in the service panel or subpanel directory, and the termination location shall be marked as “EV Ready”. The conduit for an outdoor EV Ready Space shall be located underground and be protected from water.

R404.2.2 (N1104.2.2) Multifamily dwellings (three or more units). EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table R404.2.2, so that the total number of such spaces equals the number of dwelling units for which parking spaces are made available to residents. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a multifamily project is built in phases, the minimum number of required spaces shall be determined separately for each phase. EVSE shall be installed as residents of dwelling units acquire EVs and request EV charging facilities. Raceways to outdoor parking spaces shall be located underground and protected from water.

R404.2.3 (N1104.2.3) Identification. .

The service panel or subpanel circuit directory shall identify the spaces reserved to support EV charging as “EVSE Installed,” “EV Capable” or “EV Ready” and shall be updated as EVSE Installed Spaces are created. The raceway location shall be permanently and visibly marked as “EV Capable”. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

Table R404.2.2 Minimum EVSE Installed, EV Ready and EV Capable Spaces. Table R404.2.2 Minimum EVSE Installed, EV Ready and EV Capable Spaces

Type of space	Minimum number of EV spaces installed at completion of construction or phase of construction
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EVSE Installed Spaces	Greater of 1 or 15% of total number of dwelling units offered parking
EV Ready Spaces	Greater of 1 or 15% of total number of dwelling units offered parking
EV Capable Spaces	Total number of dwelling units minus the sum of (EVSE Installed Spaces plus EV Ready spaces)

N202 General Definitions. ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, electric motorcycles and the like, which is primarily powered by an electric motor that draws current from a rechargeable storage battery. A “plug-in hybrid” is a type of electric vehicle which relies on a combination of a rechargeable storage battery and another source of motive power.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or charging apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. A designated parking space which is provided with electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for EVSE, and with an adequately-sized raceway from the panel to a clearly identified location within three feet of the parking space, to support future EVSE.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit and adequate electric panel capacity and space to electrify EVSE. The circuit shall terminate in a suitable termination point, such as a receptacle, junction box, or an EVSE, located within three feet of the parking space.

N1104.2 Electric Vehicle (EV) charging for new residential construction. New construction shall provide and facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70). **Exception:** EV Ready Spaces are not required where no parking spaces are provided to residents.

N1104.2.1 One- and two-family dwellings and townhouses. For each dwelling unit, provide at least one EV Ready Space in a garage or outdoor parking area. The branch circuit shall be identified as “EV Ready” in the service panel or subpanel directory, and the termination location shall be marked as “EV Ready”. The conduit for an outdoor EV Ready Space shall be located underground and be protected from water.

Exception: EV Ready Spaces are not required where no parking spaces are provided to residents.

N1104.2.2 Multifamily dwellings (three or more units). EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table R404.2.2, so that the total number of such spaces equals the number of dwelling units for which parking spaces are made available to residents. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a multifamily project is built in phases, the minimum number of required spaces shall be determined separately for each phase. EVSE shall be installed as residents of dwelling units acquire EVs and request EV charging facilities. Raceways to outdoor parking spaces shall be located underground and protected from water.

N1104.2.3 Identification. The service panel or subpanel circuit directory shall identify the spaces reserved to support EV charging as “EVSE Installed,” “EV Capable” or “EV Ready” and shall be updated as EVSE Installed Spaces are created. The raceway location shall be permanently and visibly marked as “EV Capable”. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

Table N1104.2.2 Minimum EVSE Installed, EV Ready and EV Capable Spaces. Table N1104.2.2 Minimum EVSE Installed, EV Ready and EV Capable Spaces

Type of space	Minimum number of EV spaces installed at completion of construction or phase of construction
EVSE Installed Spaces	Greater of 1 or 15% of total number of dwelling units offered parking
EV Ready Spaces	Greater of 1 or 15% of total number of dwelling units offered parking
EV Capable Spaces	Total number of dwelling units minus the sum of (EVSE Installed Spaces plus EV Ready spaces)

SECTION C202 DEFINITIONS. ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, electric motorcycles and the like, which is primarily powered by an electric motor that draws current from a rechargeable storage battery. A “plug-in hybrid” is a type of electric vehicle which relies on a combination of a rechargeable storage battery and another source of motive power.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or charging apparatus installed specifically for

the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. A designated parking space which is provided with electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for EVSE, and with an adequately-sized raceway from the panel to a clearly identified location within three feet of the parking space, to support future EVSE.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit and adequate electric panel capacity and space to electrify EVSE. The circuit shall terminate in a suitable termination point, such as a receptacle, junction box, or an EVSE, located within three feet of the parking space.

C405.10. Electric Vehicle (EV) charging readiness. New construction shall provide and facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70). **Exception:** EV Ready Spaces are not required where no parking spaces are provided to residents.

C405.10.1 Multifamily Dwellings. Multifamily buildings not covered by R404.2 (N1104.2) shall provide EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces in accordance with Table C405.10.1, such that the total number of such EV supporting spaces at least equals the number of dwelling units for which parking spaces are made available to residents. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a multifamily project is built in phases, the minimum number of required spaces shall be determined separately for each phase. EVSE shall be installed as residents of dwelling units acquire EVs and request EV charging facilities. Raceways to outdoor parking spaces shall be located underground and protected from water.

Table C405.10.1 Minimum EVSE Installed, EV Ready and EV Capable Parking Spaces.

Type of space	Minimum number of EV spaces installed at completion of construction or phase of construction
EVSE Installed Spaces	Greater of 1 or 15% of total number of dwelling units offered parking
EV Ready Spaces	Greater of 1 or 15% of total number of dwelling units offered parking
EV Capable Spaces	Total number of dwelling units minus the sum of (EVSE Installed Spaces plus EV Ready spaces)

Reason Statement: This provision is designed to provide electric charging readiness for the growing use of electric vehicles (EVs) and to meet the essential need to offer at-home charging to residents many of whom own EVs or will own EVs in the next few years. It is designed to minimize costs through phasing of EV development, with an emphasis on installing infrastructure during initial construction. One and two family dwellings and townhouses only require the basic wiring and panel capacity. The owner can add the charger or outlet when he or she has an EV. In the case of multifamily construction, the proposal requires defined numbers of initial EV Installed, EV Ready spaces and EV Capable Spaces. The total of the three categories is tied to the number of dwelling units which are eligible for parking so that all residents have an opportunity to charge an EV when one is acquired. The intent is to provide a modest number of EV Installed and EV Ready Spaces from the outset, with EV Capable Spaces for the remainder up to the number of dwelling units for which parking is provided. Buildings that house individuals receiving medical or other care may not provide parking to serve residents of all dwelling units. The proposal will benefit residents and the public, saving money and cutting pollution.

Providing access to home charging is important as a matter of equity. Although the purchase cost of EVs is currently higher than the low end of vehicles with combustion engines, the purchase price is falling as competition grows and, more importantly, the EV savings in fuel and maintenance costs more than pay for the initial price difference. Also, air pollution from traditional vehicles is particularly harmful to low-income residents of Virginia.

EVs are growing in importance and will continue to grow in importance as climate risks compel shifting to vehicles that do not emit pollution and as more people recognize the potential value of owning or leasing EVs. EVs will save EV users up to \$1900 per year in operating expenses compared to traditional vehicles (based on prices when those reviews were done).[1] Those operating savings will encourage EV sales growth and will greatly exceed the costs of pre-wiring garages and installing other necessary infrastructure during construction. Installing during construction is much cheaper than doing so by retrofit.

Vehicles are Virginia's largest source of carbon-dioxide emissions from fossil fuel combustion.[2] Even based on today's mix of generation in Virginia, DOE estimates that EVs would reduce CO2 emissions by roughly two-thirds compared to vehicles combusting gasoline.[3] Emissions from generation that supplies EVs will decline more as utilities' zero-carbon renewable energy replaces fossil-fuel generation. EVs' direct emissions are non-existent, which also has substantial health and pollution benefits compared to gasoline or diesel vehicles. Furthermore, in addition to the EV user's savings on annual operating costs (energy and maintenance), EV charging during off-peak periods can lead to a reduction of electric rates to all utility customers.[4]

There is a national goal to have 50% of new vehicles to be EVs by 2030.[5] Major vehicle manufacturers have committed to shift production to EVs over the next 10 years with a number of manufactures committing to shift to 100% EV production in the next 5-10 years.[6]At-home charging in conjunction with single or multifamily parking is particularly important to meeting the needs of EV owners and to encourage charging during utilities' off-peak periods. According to research by JD Power, "80% of EV charging is done at home—almost always overnight—or while a car is parked during the workday" and EV users strongly prefer Level 2 (220/240V) charging. [7] The capability for at-home charging will substantially reduce barriers to EV adoption that arise from the inconveniences that EV charging is slower than pumping gasoline, the public infrastructure for charging is still limited, and drivers have limited ability to take advantage of off-peak rates without home-charging. Going forward, utilities may get the added benefit of being able to draw on the batteries of parked electric vehicles in order meet peak demands and balance fluctuating loads. Installing the wiring and basic infrastructure during construction when walls are open and workers are present is much cheaper than retrofitting which may damage wall board and require more difficult extensions of wiring. Experience shows that installing a simple 220V/40 Ampere outlet (comparable to

a dryer or stove outlet) for "Level 2" EV charging, in a garage or outside close to parking spaces (e.g., on a wall near a single-family driveway), will enable an EV owner to reliably charge an EV at home, scheduling it at night or otherwise outside the utilities peak demand period for the lowest rates. The presence of the wiring from the beginning would permit low-cost installation of a different charging system preferred by the EV owner. Failure to install the EV during infrastructure will create barriers to EV adoption. Those barriers will be particularly great in the context of multifamily dwellings where retrofit costs are much higher and landlords' interests conflict with those of tenants

[1] See Consumer Reports, "EVs Offer Big Savings Over Traditional Gas-Powered Cars" (October 2020); Union of Concerned Scientists, <https://www.ucsusa.org/about/news/rural-communities-could-benefit-most-electric-vehicles> (up to \$1900/year savings for rural EV owners); <https://augustafreepress.com/deq-launches-clean-air-communities-program-aimed-at-driving-investment-in-electric-vehicle> The police department of Westport Connecticut achieved operating and maintenance savings of over \$17,000 in its first year of using a Tesla Model 3 police car instead of a fossil fuel vehicle. Among the department's conclusions: after four years the Tesla will have saved enough money to buy another Tesla, and each EV avoids emission of over 23 tons of CO₂ per year and saves \$8763 in environmental and health costs. <https://www.teslarati.com/tesla-model-3-westport-police-department-financial-analysis/> Those studies were based on much lower gas prices than exist today, which means that today's savings would be much larger.

[2]https://www.epa.gov/sites/production/files/2019-11/documents/co2ffc_2017.pdf[3] DOE estimates that an EV in Virginia emits (via electric generation) less than a third as much CO₂ as a gasoline-driven vehicle. https://afdc.energy.gov/vehicles/electric_emissions.html ; <https://evtool.ucsusa.org/>

[4] See June 23, 2020 Comments of the Sierra Club to the State Corporation Commission in SCC Docket PUR-2020-00051, Electrification of Motor Vehicles. As the comments explain, with managed off-peak charging and efficient rate structures, rising EV loads can drive down rates to all customers. Regarding operating costs, an EV has very little maintenance costs and EV's electricity cost equivalent to a gallon of gasoline, in Virginia, was \$1.16 versus roughly \$4.00/gallon today. <https://www.energy.gov/maps/egallon>

[5] <https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/>

[6] EV sales are already increasing, and every major vehicle manufacturer has committed to expand EV production and even to go all-electric over the next decade or so. Electric pick-up trucks will soon be available and there are long waiting lists for pick-ups. See <https://www.reuters.com/business/autos-transportation/us-automakers-say-they-aspire-up-50-ev-sales-by-2030-sources-2021-08-04/> <https://www.forbes.com/wheels/news/automaker-ev-plans/> ; <https://www.cnn.com/2022/01/05/chrysler-kicks-off-plans-to-go-all-electric-by-2028-with-airflow-concept.html>

<https://www.electrive.com/2021/08/05/us-carmakers-aim-for-40-50-ev-sales-by-2030/>

[7] <https://www.forbes.com/wheels/news/id-power-study-electric-vehicle-owners-prefer-dedicated-home-charging-stations/> See also James Walkinshaw, Washington Post, Jan. 23, p.C4 (explaining the importance of home charging relative to public charging). Utilities' energy sales are lowest and cheapest in off-peak hours, particularly at night. A common utility strategy is to offer time-of-use rates with low night-time prices to encourage off-peak EV charging. For EV customers to make use of such incentives, they will need access to overnight charging at home where they spend the night.

Resiliency Impact Statement: This proposal will increase Resiliency

Expanding EV utilization will enhance resiliency in multiple ways.

EVSE can be designed to deliver electricity back to a dwelling, which would protect residents during periods of power outages.

<https://www.ford.com/trucks/f150/f150-lightning/2022/> It is anticipated that EV batteries can also be connected to the grid to provide grid balancing and back up in the future.

Switching to EVs is also critical to resiliency because it will reduce CO₂, CO, SO₂, particulates, methane, and other harmful emissions from fossil-fuel combusting vehicles and from producing and delivering gasoline and diesel fuel for use in vehicles. Unlike traditional vehicles with internal combustion engines ("ICE"), electric vehicles emit no air pollution and are much more energy efficient than ICE vehicles. As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow.

According to Virginia's DEQ, "[t]he transportation sector is now the largest contributor of air pollutants and greenhouse gases in Virginia," and "[v]ehicle emissions are the largest single source of toxic and smog-forming air pollution in Northern Virginia and much of the rest of the country."

<https://www.deq.virginia.gov/air/clean-vehicles> . Transportation accounts for 48.6% of Virginia's CO₂ emissions.

<https://www.eia.gov/environment/emissions/state/>

Polluting emissions from internal combustion vehicles compound the risks of climate change and adversely impact public health. CO₂ and other emissions from fossil fuel combustion and production are the primary drivers of climate change. The most recent IPCC report confirms that rapid reductions of greenhouse gas emissions is essential to avoid catastrophic climate impacts around the world. IPCC Sixth Assessment Report (February 2022), <https://www.ipcc.ch/report/ar6/wg2/> Substantial harm has already occurred nationally and locally from global warming and much worse will follow without rapid reductions of greenhouse gases (particularly CO₂ and methane associated with fossil fuel production and combustion). Virginia's coastal areas are among the most vulnerable to sea level rise and destructive storms. They already experience "sunny day flooding," and sea level rise is accelerating. https://www.vims.edu/newsandevents/topstories/2020/slrc_2019.php Climate change is already

harming Virginia and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO₂ and methane associated with fossil fuel production and combustion). The most recent report from NOAA indicates that Virginia may face 2 feet of sea level rise by 2050 due to worsening climate change from human greenhouse gas emissions. <https://www.noaa.gov/news-release/us-coastline-to-see-up-to-foot-of-sea-level-rise-by-2050> Virginia faces climate-driven sea level rise of 6.69 feet this century; the rate of sea level rise is accelerating; the danger of climate-driven severe storms, storm-surges and flooding are rising; and climate change will increasingly harm human health and lives, agriculture, businesses, military installations, private and public property, and Virginia's economy. <http://www.vasem.org/reports/2021-the-impact-of-climate-change-on-virginias-coastal-areas/> Growing dangers also include rising atmospheric and water temperatures that worsen heat-related illnesses, disruptions of economic activity, and harms to agriculture, fisheries, and our natural heritage.

Because atmospheric CO₂ from emissions is cumulative, Virginia has less chance of mitigating and recovering from those harms the longer we delay maximizing energy savings and minimizing greenhouse gas pollution.

Shifting to EVs is a critical piece of the solution to global warming. Continuing to construct buildings that will not support use of clean EVs will make it harder to achieve climate goals, particularly since the buildings will likely remain in place for 70 years or more. Constructing buildings that cannot provide electric charging will also delay residents' ability to access large economic and energy savings from EV usage.

Building codes already recognize that fumes from traditional vehicles are dangerous. More broadly, small particle, SO₂ and other pollution from vehicles burning fossil fuels increases heart and lung disease, as well as cognitive and other disorders. <https://blog.ucsusa.org/dave-reichmuth/air-pollution-from-cars-trucks-and-buses-in-the-u-s-everyone-is-exposed-but-the-burdens-are-not-equally-shared/> As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow particularly if we shift vehicles to clean electricity. Local air pollution harms caused by vehicle pollution will also be reduced which will particularly benefit high-traffic areas, including low-income urban areas.

Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will somewhat increase the cost of constructing parking, but the increase will be small compared to the total cost of construction and the benefits to residents and the public. EVs with home charging will save occupants money and avoid the higher costs of retrofitting in the future.

The incremental cost of installing the electric equipment will be low when a residence is constructed (perhaps 0.0005-0.003 of an average new home or less). It is easy to install the wires, panel capacity and conduits for electric vehicle charging--along with the rest of a dwelling's wiring--when a single or multifamily dwelling is built. It is much harder and much more expensive to do so as a retrofit. The branch circuit would cost a few dollars per foot. In a single-family dwelling garage or carport, for example, a branch circuit would need to be run from the circuit breaker, which is simple when other outlets are being installed during construction. However, as a retrofit, this basic wiring could require much higher costs from complicated feeding of a line and possible need to repair wall damage. If an electric panel is located in a garage, it will be particularly inexpensive to install an outlet during initial construction because the run would be short, potentially a couple of feet.

In a large multifamily building, the cost would be greater than a single-family dwelling due the larger garage or parking lot size and possibly the garage design. However, the costs of the infrastructure required by the proposal are still low compared to the overall construction cost, to potential retrofit costs, to residents' long-term savings from EVs, and to harm from impeding tenants' ability to reduce carbon and other pollutants which will reduce pollutants and benefit the public. The cost can be minimized by locating the EVSE (or future location for the EVSE) close to the electrical panels. The proposal limits the costs both by limiting the requirement to one space per dwelling unit for which parking is offered and by allowing deferral of some costs for EV Ready and EV Capable spaces.

The proposed multifamily requirements are tied to the number of dwelling units and staged as spelled out in the Table, so that residents of every dwelling unit will have the opportunity to home-charge an EV, and the remaining electrical wiring and charger costs would only be incurred as occupant demand grows. (Couples in a unit can share a charger.) In submissions to the IECC as part of the 2021 IECC review process, data indicated that the cost of retrofitting commercial parking to EV ready status would be 3-8 times higher than doing to work at the time of building construction. See IECC Proposal CE217-19 Part 1(Cost Impact discussion). Such high retrofit costs will deter future retrofits and act as a barrier to EV access by residents of multifamily dwellings, potentially for decades.

REC-R402.4-21

VCC: 1301.1.1.1

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the International Energy Conservation Code (IECC).

21. ~~Change Sections R402.4 and R402.4.1.1 to read:~~

~~**R402.4 Air leakage.** The *building* thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.~~

~~**R402.4.1.1 Installation (Mandatory).** The components of the *building* thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of *construction*. Where required by the code official, an *approved* third party shall inspect all components and verify compliance.~~

22. ~~Change the title of the "Insulation Installation Criteria" category of Table R402.4.1.1; change the "Shower/tub on exterior wall" category of Table R402.4.1.1, and add footnotes "b" and "c" to Table R402.4.1.1 to read:~~

23. ~~Change Section R402.4.1.2 to read:~~

~~**R402.4.1.2 Testing.** The *building or dwelling unit* shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in Climate Zone 4. Testing shall be conducted in accordance with RESNET/IGC 380, ASTM E779, or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). A written report of the results of the test shall be signed by the party conducting the test and provided to the *building official*. Testing shall be conducted by a Virginia licensed general contractor, a Virginia licensed HVAC contractor, a Virginia licensed home inspector, a Virginia *registered design professional*, a certified BPI Envelope Professional, a certified HERS rater, or a certified duct and envelope tightness rater. The party conducting the test shall have been trained on the *equipment* used to perform the test. Testing shall be performed at any time after creation of all penetrations of the *building* thermal envelope.~~

~~**Note:** Should additional sealing be required as a result of the test, consideration may be given to the issuance of a temporary certificate of occupancy in accordance with Section 116.1.1.~~

~~During testing:~~

- ~~1. Exterior windows and doors and *fireplace* and stove doors shall be closed, but not sealed beyond the intended weatherstripping or other infiltration control measures;~~
- ~~2. Dampers, including exhaust, intake, makeup air, backdraft, and flue dampers, shall be closed, but not sealed beyond intended infiltration control measures;~~
- ~~3. Interior doors, if installed at the time of the test, shall be open;~~
- ~~4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;~~
- ~~5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and~~
- ~~6. Supply and return registers, if installed at the time of the test, shall be fully open.~~

24. ~~Change Section R403.3.3 to read:~~

R403.3.3 Duct testing (Mandatory). ~~Ducts shall be pressure tested to determine air leakage by one of the following methods:~~

- ~~1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.~~
- ~~2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.~~

~~**Exception:** A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.~~

~~A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. The licensed mechanical contractor installing the mechanical system shall be permitted to perform the duct testing. The contractor shall have been trained on the equipment used to perform the test.~~

Reason Statement: The purpose of this proposal is to bring Virginia's standards for air leakage testing and air leakage rates into full compliance with the 2021 IECC from which the new language is drawn.

The air leakage level permitted by Virginia's 2018 Energy Conservation Code predates the 2012 IECC, which required air leakage to not exceed 3.0 air changes per hour in Virginia's climate zones. Retaining the 5.0 ACH level would make Virginia's USBC more than a decade behind the IECC, and plainly out of compliance with statutory standards. Sections 36-99A and 36-99B of the Virginia Code make clear that building codes are required to "protect the health, safety and welfare of the residents of the Commonwealth" and that deviations to reduce construction costs must nevertheless be "consistent with recognized standards of health, safety, energy efficiency and water efficiency." H2227, which was enacted in 2021, calls for adoption of energy efficiency standards that are "at least as stringent" as the latest IECC.

Reducing the maximum air infiltration to 3 air changes per hour was established as technically and economically viable when the 2012 IECC was promulgated. Following promulgation of the 2012 IECC, DOE found that the changes from 2009 improved efficiency and was cost effective for occupants in that they saved money every year and quickly recouped the cost of construction. DOE/PNNL, *National Energy Cost Savings for New Single and Multifamily Homes, A Comparison of the 2006, 2009, and 2012 Editions of the IECC*, <https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf>

The IECC requirement has remained at 3 air changes per hour in the 2015, 2018 and 2021 IECCs. If there were any technical or economic reason to adopt 5 ACH in Virginia's climate zones, the ICC has had three cycles to make the adjustments, but it has not done so. There is no valid reason for Virginia to continue to permit leaky houses that require additional heating and cooling in order to offset the infiltration of outside air.

Tightening building air sealing to test at 3 (versus 5) air changes per hour (a.k.a. "3 ACH" or "3 ACH50") is important to residents who will save money, experience greater comfort and a healthier home. Every additional air change requires additional heating and conditioning of air in the dwelling, and reflects poor sealing which leaves gaps for pests to enter the dwelling. While indoor humidity can be an issue in buildings (regardless of the tightness of construction) during periods in which spaces are not being heated or cooled, it is not a valid reason for refusing to implement the IECC's long-established standards for 3 ACH since greater air to flow through walls and ceilings increases the risks that moisture will be captured inside walls and insulation increasing the risks of mold and deterioration.

There is a broad consensus among recognized standards that tighter sealing of walls protects the health, safety and welfare of residents. To address indoor air issues, the IECC has long required whole-house mechanical ventilation for buildings that test at less than 5 ACH and has modified the envelope barrier standards. DOE has even tighter standards (2.5 ACH50 for Climate Zone 4) for its Zero-Energy program, and Passive House standards call for 0.6 ACH50. <https://basc.pnnl.gov/information/infiltration-meets-ach50-requirements> ; <http://passivehousebuildings.com/books/phc-2019/five-principles-of-passive-house-design-and-construction/> The National Association of Home Builders has also recognized many benefits from minimizing air leakage.[1] And, EPA encourages tighter sealing of walls to reduce air infiltration (including infiltration of humid air), reduce energy waste, reduce the risks of indoor air pollution, reduce humidity and mold in walls, and reduce risks of infiltration by insects and rodents—another specific concern in Virginia's building code, which we cited. As EPA has stated, in *EnergyStar: A complete Thermal Enclosure System* (2017):

The energy savings from comprehensive air sealing can quickly add up when you consider all the places hot or cool air can enter or escape from your home. Having a well-sealed home also means better air quality because dirt, pollen, pests, and moisture can't get in as easily. In addition, good sealing practices help protect your home against mold and moisture damage that can be caused by condensation.

[1] See NAHB, et al., "TechNote – Building Tightness Code Compliance & Air Sealing Overview", which (a) states "Air leakage in a building should be minimized;" (b) identifies benefits to residents including "Heating & cooling energy savings; Reduced potential for moisture movement through the building thermal enclosure; Improved insulation effectiveness and reduced risk of ice dams; Reduced peak heating and cooling loads resulting in smaller HVAC equipment; Improved comfort (reduces drafts and noise); Improved indoor air quality (limits contaminants from garages, crawl spaces, attics, and adjacent units)" and (c) suggests a possible construction strategy with a goal of 2.5 ACH – stricter than the IECC.

Resiliency Impact Statement: This proposal will increase Resiliency

Improving building energy efficiency with the 3 ACH standard will increase resiliency compared to Virginia's outdated 5 ACH standard. By reducing the volume of air that needs to be reheated or cooled every day, the proposal will reduce energy usage and cost burdens. By better preserving indoor conditioned temperatures, it will help residents and communities withstand periods of power outages from storms or other causes. Improving envelope efficiency will also reduce burdens on utilities which will help them better cope with storms and other difficulties.

By reducing demands for energy generation, tightening construction will also help mitigate climate impacts and prepare Virginia's buildings and economy for a future that requires the least energy usage and related pollution possible. Climate change is already harming Virginia and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO₂ and methane). Growing climate dangers include harms to communities, infrastructure, people, property and the economy from rising seas, worsening storms and more severe rainfall events. Growing dangers also include rising atmospheric and water temperatures that threaten worsening heat-related illnesses, limits on economic activity, agriculture, fisheries, and our natural heritage. The likelihood of mitigating and recovering from those harms declines the longer we delay maximizing energy savings and minimizing GHG pollution.

Furthermore, saving energy will reduce occupants' utility bills while increasing their comfort. Reducing energy cost burdens will improve the *economic resiliency* of all residents, but particularly low and moderate income customers most harmed by high bills. It will also the *economic resiliency* of lenders, landlords and communities by reducing loan defaults and residents' choices between paying energy bills and rent, mortgages and other basic family needs. With buildings lasting 70 or more years, there is no excuse for not meeting standards established 10 years ago.

Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will increase the cost of construction in some, but not all projects, *i.e.*, primarily when blower door tests reveal an excess of air leakage between 3 and 5 ACH. A well planned and built house should meet the 3 ACH standard, and the additional costs of caulking and other sealing techniques are limited. To the extent a blower door test reveals leaks between 3 and 5 ACH, the additional cost will typically involve filling envelope gaps with caulk and other materials which are not costly. It may take some looking to find the gaps, but it shouldn't be hard to block the leaks. Greater care by builders during the framing, insulating and sealing processes will avoid having to go back and fix leaks.

On the other hand, residents will save money and experience other benefits by reducing the volume of air changes that have to be reheated, re-cooled or dehumidified. Retrofitting to achieve the same level of tightness after walls have been closed up could require going behind walls and would be much more difficult and costly to building owners than doing the job well during the construction phase. As noted in the Reason Statement, DOE/PNNL found that the 2012 IECC changes, including the air tightness standards, would save residents money year in and year out, on a life-cycle basis. DOE/PNNL, *National Energy Cost Savings for New Single and Multifamily Homes, A Comparison of the 2006, 2009, and 2012 Editions of the IECC*, <https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf> If the costs had outweighed the benefits of the 3.0 ACH leakage standard, the ICC could have raised the permissible leakage rate any time in the four cycles 2012-2021. It did not, and Virginia should no longer deny the benefits to occupants of newly constructed dwellings. (Although the data published by DOE/PNNL amply demonstrates that full compliance satisfies the statutory standards, more detailed data and analysis can be requested by DHCD from PNNL, if desired.)

REC-R403.1.1.1-21

IECC®: SECTION 202 (New), R403.1.1.1 (New)

Proponents: Ben Rabe (ben@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a *demand response signal*.

R403.1.1.1 Demand responsive thermostat controls. R403.1.1.1 Demand responsive thermostat controls. The thermostats shall be provided with *demand responsive controls* that comply with AHRI 1380 capable of the following:

1. Automatically increasing the zone operating cooling set points by a minimum of 4 °F (2.2 °C)
2. Automatically decreasing the zone operating heating set points by a minimum of 4 °F (2.2 °C)
3. Automatically decreasing the zone operating cooling set points by a minimum of 2 °F (1.1 °C)
4. Automatically increasing the zone operation heating set points by a minimum of 2 °F (1.1 °C)
5. Both ramp-up and ramp-down logic to prevent the building peak demand from exceeding that expected without the DR implementation.

The thermostat shall be capable of performing all other functions provided by the control when the *demand responsive controls* are not available.

Exception: Assisted living facilities.

Reason Statement: According to a new report from the National Association of Home Builders (NAHB), in 2021, homeowners will be seeking out features for their homes that improve comfort, wellness and efficiency. One of these common home features homeowners are seeking out are ways to improve their overall home energy use. To help lower energy bills, home builders install a smart thermostat to regulate temperatures and install ENERGY STAR appliances. Major builders D.R. Horton and Toll Brothers are both partners with smart home technology which are installed in the homes they build (these include smart thermostats). Grid-integrated controls for thermostats are added based on language from California Title 24 and integrated into the current requirement for thermostats. Any thermostat listed as "Title 24 compliant" would meet this requirement, and are available directly through major retailers.

Smart thermostat demand response is becoming one of the most pervasive utility offering throughout the country. In their 2019 Demand Response Market Snapshot, SEPA found that 58 utilities had smart thermostat offerings, comprising 1 GW of connected load. In their assessment of US national potential for load flexibility, Brattle found that smart thermostats were the largest single program offering in their estimated 200 GW of potential by 2030. As shown in the figure below, LBNL modeling for the DOE GEB roadmap shows that demand response thermostats can reduce building peak demand by up to 30%. The substantial savings impact variability is because LBNL modeled impacts at times driven by typical utility peak hours based on the utility grid region but that does not necessarily align with building peak hours. If the two are aligned, the impacts are maximized; if impacts are misaligned impacts may be shown as negative. Therefore, these impacts should not be considered to be "typical" or "maximum" in each case. To ensure the inclusion of demand response controls are treated as mandatory the thermostat requirements are added to the tropical compliance list under R407.2.

Resiliency Impact Statement: This proposal will increase Resiliency

Resiliency is an essential component of adapting to the effects of climate change. As we see increasing number of severe weather events, the electric grid's ability to withstand these events will become increasingly important. Demand controlled thermostats will help integrate building loads with available production, lowering energy demand. Therefore, this proposal increase resiliency by reducing overall demand on the grid.

Cost Impact: The code change proposal will increase the cost of construction

In 2011, demand response thermostats (which were estimated to cost \$68 more than a programmable thermostat) were found to be extremely cost effective.³ It was estimated that for every dollar spent on a grid-integrated thermostat in 2011 yielded between \$2 to \$9 in operating cost savings over a 15-year period. In the 10 years since, equipment prices have decreased. One can purchase a basic grid-integrated thermostat for \$63 compared to a basic 7-day programmable thermostat which costs \$42. Including labor costs and a 35% markup to account for direct and indirect costs of construction, the incremental construction cost of installing a demand responsive thermostat is currently estimated to be \$40 making this measure even more cost effective than estimated previously. Not only will this measure result in cost savings to consumers, but it will also result in other significant societal benefits. According to DOE's report, "A National Roadmap for Grid-Interactive Efficient Buildings", every watt in peak demand savings was found to create 17 cents in annual electric grid system value. This value included energy savings, capacity savings, transmission deferral and ancillary services. A single-family home with a grid-integrated thermostat which is estimated to reduce peak demand savings between 0.26 to 1.09kW would result in \$43 to \$181 in annual electric grid system value. Grid-integrated thermostats which allow grid operators to reduce demand on the grid during the times when the carbon intensity of the electric grid is high also results in reduced

carbon emissions generating additional significant societal benefits.

REC-R403.1.2-21

VEBC: 603.5.2 (New); VECC: R403.1.2, R403.1.3 (New)

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Existing Building Code

Add new text as follows:

603.5.2 Heat Pump as Primary Space Heat Source. Electric resistance heat shall not be used as the primary electric heat source for space heating in new residential construction or as a replacement for a heat pump in existing dwelling units

2018 Virginia Energy Conservation Code

Revise as follows:

R403.1.2 Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load. Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load. Except in emergency heating mode, the supplementary electric-resistance heat in heat pump systems installed in new construction may not energize unless the outdoor temperature is below 40° F (4° C).

Add new text as follows:

R403.1.3 Heat Pump as Primary Space Heat Source. Electric resistance heat shall not be used as the primary electric heat source for space heating in new residential construction or as a replacement for a heat pump in existing dwelling units

Reason Statement: Electric resistance heat is a highly inefficient form of space heating when compared to electric heat pumps. Heat pumps are roughly 300% more efficient. <https://mygreentomontgomery.org/2021/environmental-and-economic-advantages-of-switching-to-an-electric-heat-pump/> Baseboard electric heating also distributes heat poorly compared to ducted systems or mini-splits. Reliance on electric resistance heat for a primary heat source (as opposed to a supplemental resistance element in a heat pump for especially cold conditions) raises heating costs for residents compared to electric heat pumps. Electric resistance heating also imposes substantial seasonal and peak-period cost burdens on electric utilities, which get passed on to other utility customers.

Compared to resistance heating, heat pumps substantially reduce a customer's heating bills--by 50% compared to resistance heat according to DOE. <https://www.energy.gov/energysaver/heat-and-cool/heat-pump-systems> For these reasons, the proposal would restrict installation of electric resistance heating and of heat pumps that are designed to activate resistance back-up when outdoor temperatures are above 40°F.

Heat pumps also incorporate air conditioning, which provides customers with the health and comfort benefits of cooling in the summer and avoids the cost of installing air conditioning units during construction. Builders have the option to install whole-house, ducted heat pumps or "mini-split" heat pumps without no ducts. Heat pumps are appropriate for large or small dwellings and additions.

The proposal is modeled on a Georgia building code provision (R403.1.2).

Resiliency Impact Statement: This proposal will increase Resiliency

This proposal will increase Resiliency. Heat pumps effectively heat dwellings while reducing the peak demands placed on utilities in winter months. Such demand reductions reduce risks of utility outages. Heat pumps also provide year round comfort since they both heat and cool.

Climate change poses an ever-greater resiliency threat the longer we fail to reduce greenhouse gas (GHG) emissions. It poses an ever-growing risk of heat-illness, floods, storms, sea level rise, air and ocean heating, and other disasters that threaten residents and the economy. The need to swiftly reduce carbon emissions has been recognized by multiple agencies of the U.S. government (e.g., EPA, DOE, NAS, Global Change Research Program), by international agencies (e.g., U.N., IPCC, IEA), as well as by Virginia (e.g., in Governor Northam's Executive Order 43 (2019) and in 2020 legislation by the General Assembly). Improving the efficient use of energy is recognized as a critical measure to reduce GHG emissions and harmful climate impacts, as well as to reduce land and water pollution and overall utility costs to consumers. This proposal will replace highly inefficient resistance heating with much more efficient heat pumps.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal may, but will not necessarily, increase the cost of construction. However, it will substantially reduce total costs occupancy and lifecycle to residents.

Resistance space heating may be cheaper to install than a standard heat pump or mini-split heat pump. However, it does not provide air conditioning which is an inherent part of a heat pump, including a mini-split. Adding a stand-alone air conditioning unit to a resistance heating unit can make the total cost greater. Like baseboard electric heat, mini-splits do not require duct work. Comparable duct work would be required for both electric furnaces and central heat pumps.

The additional upfront cost of a heat pump or mini-split compared to resistance heat will be recovered by the owner or tenant through energy cost savings attributable to a heat pump's much greater energy efficiency. As noted, DOE reports that heat pumps can reduce heating costs by 50% compared to resistance heat. <https://www.energy.gov/energysaver/heat-and-cool/heat-pump-systems>.

Since a heat pump or mini-split provides air conditioning, it will also provide a form of seasonal comfort, including summer dehumidification, not produced by any form of electric resistance unit. Cooling in periods of intense heat is important for the health of residents, as has been recognized by the BHCD. The hazards of heat illness are growing with climate change and the associated health care costs need to be considered.

By reducing demands on utilities for expensive generation to meet peak demands and by reducing air pollution emissions from power generation, heat pumps will also reduce costs to utility customers generally and pollution costs to the public generally.

REC-R403.5.4-21

IECC®: SECTION 202 (New), R403.5.4 (New), ANSI Chapter 06 (New)

Proponents: Ben Rabe (ben@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a demand response signal.

R403.5.4 Demand Responsive water heating. Electric storage water heaters with a rated water storage volume between 40 and 120 gallons and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls that comply with ANSI/CTA-2045-B Level 2, except "Price Stream Communication" functionality as defined in the standard, or another equivalent approved demand responsive control.

Revise as follows:

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

ANSI/CTA-2045-B

Modular Communications Interface for Energy Management.

Reason Statement: With increasing penetrations of intermittent renewable energy, volatile wholesale power prices, and subsequent growth in dynamic rates/demand response programs, grid-interactive end uses present an opportunity to help homes manage their bills, participate in programs, and support efficient grid operations. Water heaters can provide many services to the grid, including generation, transmission, and distribution capacity, energy arbitrage, and ancillary services.

As electricity systems transform to include more variable wind and solar energy, demand flexibility becomes increasingly critical to both grid operation and further transformation. Building systems that can use energy when it is abundant, clean, and low-cost not only help decarbonize the entire energy system, they also insulate their owners from future increases in demand charges and peak hour energy rates – a current and accelerating trend. Water heaters offer an unparalleled opportunity for load shifting: tanks full of hot water are inherently energy storage devices. Including the controls necessary to take advantage of this opportunity is relatively simple and affordable in new construction. Compared to other energy storage technologies such as batteries, smart, grid-integrated water heater controls can deliver substantial dispatchable (that is, reliable to the grid operator) energy flexibility. The controls specified by ANSI/CTA-2045-B ensure negligible risk of occupant disruption (that is, the hot water will not run out). Water heaters provide a particularly attractive option as they have inherent thermal storage that allows energy consumption to be shifted with little to no impact to the end user. This capability has been demonstrated in several contexts, most recently through regional demonstrations conducted by EPRI and BPA.

In their Grid-interactive and Efficient Buildings (GEBs) Roadmap, the US Department of Energy estimates that approximately 15 GW of additional load flexibility is expected to be added to the system under reference case assumptions. Combined with energy efficiency, this is expected to provide \$13 billion/year of peak demand savings to the power system and its customers. Through a comprehensive literature review and interviewing dozens of national experts, the USDOE team found that one of the biggest barriers was the lack of interoperability. A key tool to solve this problem is building codes, which can help to ensure that interoperable devices and controls are installed at the time of construction. USDOE cited explicitly the use of codes and standards as one of its recommended pathways to enable greater adoption of GEBs technologies.

ANSI/CTA-2045-B standardizes the socket, and communications protocol, for electric water heaters so they can communicate with the grid, and with demand response signal providers. In addition, 2045-B adds control and communications requirements for mixing valves in water heaters, which enable them to provide greater storage capacity to support increased load shifting while eliminating scalding risk.

Resiliency Impact Statement: This proposal will increase Resiliency

Demand responsive controls allow for utilities to send and buildings to receive signals to ramp up or down set points based on a variety of conditions. This communication ability is a critical aspect of resilience for our communities. Storage water heaters have a unique capability to act as thermal storage "batteries". By allowing water heaters to receive a signal from the grid, water can be heated at a time when overall demand, price signals or carbon emissions are at their lowest. Pre-heating water in this way can help to lessen peak demands on the grid, creating grid resiliency, reduce costs for consumers, creating financial resiliency, and help absorb excess renewable generation, or at a minimum engage during the cleanest hours of generation, reducing carbon emissions and climate impact of water heating.

Cost Impact: The code change proposal will increase the cost of construction

Demand controls for water heaters which costs around \$173 [AM1] become cost effective when enrolled in a demand response program. Armada Power customers in Ohio who enrolled their water heaters in a demand response program saved \$184 annually by enrolling in the program. If utilities nationwide instituted a similar program to shape demand, a customer could reap \$12 in energy cost savings for every \$1 spent on the additional controls. Customer cost savings are likely to increase in many locations as utilities deploy more time-of-use rate structures, increase

demand charges, and expand the daily and seasonal periods during which these rate components apply.

Not only will this measure result in cost savings to consumers, but it will also result in other significant societal benefits. According to DOE's report, "A National Roadmap for Grid-Interactive Efficient Buildings", every watt in peak demand savings was found to create 17 cents in annual electric grid system value. This value included energy savings, capacity savings, transmission deferral and ancillary services. A 3-bedroom, 2-bath apartment with a grid-integrated water heater is estimated to reduce peak demand savings by 0.3kW, which would result in \$51 in annual electric grid system value. Grid-integrated water heaters which allow grid operators to reduce demand on the grid during the times when the carbon intensity of the electric grid is high, which also results in reduced carbon emissions – generating additional significant societal benefits.

REC-R404.2-21

VECC: R404.2 (New); VCC: N1104.2 (New)

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

R404.2 SOLAR-READY CONSTRUCTION FOR DETACHED ONE- AND TWO-FAMILY DWELLINGS AND TOWNHOUSES. New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m²) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Appendix RA Solar Ready Provisions--Detached One- and Two-Family Dwellings and Townhouses. [NOTE: denominated Appendix RB in 2021 IECC].

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.
2. A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.



2018 Virginia Construction Code

Add new text as follows:

N1104.2 Solar Ready Construction for Detached One- And Two-Family Dwellings and Townhouses. New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m²) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Appendix RA Solar Ready Provisions--Detached One- and Two-Family Dwellings and Townhouses. [NOTE: denominated Appendix RB in 2021 IECC].

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.
2. A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

Reason Statement: This proposed addition to the body of the building code is designed to require builders to make new one- and two-family dwellings and townhouses "solar ready", subject to certain specific exceptions. The proposal does not require builders to install solar. However, it would enable buyers to arrange for cheaper, easier installation of rooftop solar if they choose to do so in the future. It is a low-cost measure that will reduce the cost of adding solar at a later date. The proposal is based up on the Appendix RA in the 2018 Virginia building code, which has been updated as Appendix RB in the 2021 IECC. Since the Appendix is in the current code and has not been modified from the 2018 code, it will presumptively follow the 2021 IECC's equivalent appendix, Appendix RB.

Rooftop solar energy production will reduce occupants' utility bills by reducing the quantity of energy they need to purchase for heating, lighting and other purposes. That will tend to stabilize and reduce their annual energy costs. Further, distributed generation will reduce the quantity of energy that utilities need to generate or purchase, the generation and transmission facilities to be constructed, and the line losses that would result from transmitting energy to markets from central power stations. Distributed energy production will help to save overall energy costs.

Distributed zero-carbon generation will also reduce greenhouse gas emissions, which are the primary driver of climate change and its many harmful impacts, including rising seas, flooding, dangerous high temperatures, agricultural disruption and threats to infrastructure.

Resiliency Impact Statement: This proposal will increase Resiliency

This low-cost proposal will increase resiliency for residential customers who install solar and for the utility system. Residential customers with solar will generate energy on-site, which will lower energy and total occupancy costs, reducing risks of lease and mortgage defaults. In combination with on-site battery storage, the on-site solar can power the house during periods of power outages. Distributed solar can also support utility's regional reliability when power outages occur at remote central generating stations.

Solar generation is zero-carbon, which makes it a necessary measure to mitigate worsening climate impacts which harms Virginia and its residents generally. The most recent IPCC report confirms that rapid reductions of greenhouse gas emissions is essential to avoid catastrophic climate impacts around the world. *IPCC Sixth Assessment Report* (February 2022), <https://www.ipcc.ch/report/ar6/wg2/> Substantial harm has already occurred nationally and locally from global warming and much worse will follow without rapid reductions of greenhouse gases (particularly CO₂ and methane associated with fossil fuel production and combustion). Virginia's coastal areas are among the most

vulnerable to sea level rise and destructive storms. The most recent report from NOAA indicates that Virginia may face 2 feet of sea level rise by 2050 due to worsening climate change from human greenhouse gas emissions. <https://www.noaa.gov/news-release/us-coastline-to-see-up-to-foot-of-sea-level-rise-by-2050>

Growing climate dangers include harms to communities, infrastructure, people (e.g., heat-related illnesses, disease vectors and ability to work), agriculture, property (inland and coastal) and the economy. These result from many climate-driven forces, including rising temperatures and seas, wildfires, worsening storms, more severe rainfall events and damage to crops and infrastructure. In addition, by cutting greenhouse gas emissions, solar generation will help to mitigate the growing impacts that warming seas and ocean acidification have on sea life and Virginia's fisheries. Even if Virginia were not directly endangered, its residents, economy and access to resources would be endangered by the growing harms to the rest of the nation and the world.

Cost Impact: The code change proposal will increase the cost of construction

There will be a small increase in the initial cost of construction, which will be offset by encouraging building owners to install money-saving, GHG-reducing rooftop solar in the future. (Obviously, builders decide to install and profitably market the dwelling with rooftop solar if they desire to do so.) The principal material cost would be a 1-inch electrical conduit, which can be purchased for \$2.00/foot or less, i.e., less than \$100 from the roof to the electrical panel. During construction, the cost of installation will be a small increment given that the walls will be open and tradesmen will be installing similar conduits and/or wiring in the building. The costs of retrofitting are likely to be much higher after walls are closed and construction completed. Reopening and repairing walls could be required.

The small upfront costs will have little impact on a resident's annual mortgage costs, particularly when compared to the savings that will result from self-generated solar energy and from the much higher cost of retrofitting.

REC-R404.4-21

IECC®: R103.2.3 (New), R105.2.3, R105.2.5 (New), R105.2.5, SECTION 202 (New), R401.3, R404.4 (New), TABLE R405.2, TABLE R406.2

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

R103.2.3 Solar-ready system . The construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from *solar-ready zone* to electrical service panel or plumbing from *solar-ready zone* to *service water heating* system for the *solar-ready zone* shall be represented on the construction documents.

Revise as follows:

R105.2.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and *approved* plans and specifications as to types of insulation and corresponding *R*-values and protection, and required controls. Where the solar-ready zone is installed for solar water heating, inspections shall verify pathways for routing of plumbing from solar-ready zone to service water heating system.

Add new text as follows:

R105.2.5 Electrical rough-in inspection. Inspections at electrical rough-in shall verify compliance as required by the code and the approved plans and specifications as to the locations, distribution, and capacity of the electrical system. Where the solar-ready zone is installed for electricity generation, inspections shall verify conduit or pre-wiring from solar-ready zone to electrical panel.

Revise as follows:

~~R105.2.5~~ **R105.2.6 Final inspection.** The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* systems, equipment and controls and their proper operation and the required number of high-efficacy lamps and fixtures.

SOLAR-READY ZONE. A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

R401.3 Certificate. A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

1. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, *crawl space walls* and floors and ducts outside *conditioned spaces*.
2. *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.
3. The results from any required duct system and building envelope air leakage testing performed on the building.
4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. Where on-site *photovoltaic panel* systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.
6. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.
7. The code edition under which the structure was permitted and the compliance path used.
8. Where a solar-ready zone is provided, the certificate shall indicate the location, dimensions, and capacity reserved on the electrical service panel.

Add new text as follows:

R404.4 Renewable energy infrastructure. The building shall comply with the requirements of R404.4.1 or R404.4.2

R404.4.1 One- and two- family dwellings and townhouses. One- and two-family dwellings and townhouses shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. A building with a permanently installed on-site renewable energy system.
2. A building with a solar-ready zone area that is less than 600 square feet (55 m²) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A building with a solar-ready zone area that is shaded for more than 70 percent of daylight hours annually.

R404.4.1.1 Solar-ready zone area. The total area of the *solar-ready zone* shall not be less than 300 square feet (28 m²) and shall be composed of areas not less than 5.5 feet (1676 mm) in width and not less than 80 square feet (7.4 m²) exclusive of access or set back areas as required by the International Fire Code.

Exception: Townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (186 m²) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m²).

R404.4.1.2 Obstructions . Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.4.1.3 Electrical service reserved space . The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric." The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.

R404.4.1.4 Electrical interconnection. An electrical junction box shall be installed within 24 inches (610 mm) of the main electrical service panel and shall be connected to a capped roof penetration sleeve or a location in the attic that is within 3 feet (914 mm) of the *solar ready zone* by one of the following:

1. Minimum ¾-inch nonflexible conduit
2. Minimum #10 Metal copper 3-wire

Where the interconnection terminates in the attic, location shall be no less than 12" (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

R404.4.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Section C405.13.

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION ^a	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation installations
R402.4.1.1	Installation
R402.4.1.2	Testing
R402.5	Maximum fenestration U-factor and SHGC
Mechanical	
R403.1	Controls
R403.3, including R403.3.1, except Sections R403.3.2, R403.3.3 and R403.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
404.2	Interior lighting controls
R404.4	<u>Renewable Energy Infrastructure</u>

a. Reference to a code section includes all the relative subsections except as indicated in the table.

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION ^a	TITLE
General	
R401.2.5	Additional efficiency packages
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation installation
R402.4.1.1	Installation
R402.4.1.2	Testing
Mechanical	
R403.1	Controls
R403.3 except Sections R403.3.2, R403.3.3 and R403.3.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water calculation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
404.2	Interior lighting controls
<u>R404.4</u>	<u>Renewable Energy Infrastructure</u>
R406.3	Building thermal envelope

a. Reference to a code section includes all of the relative subsections except as indicated in the table.

Reason Statement: In 2020, renewable energy sources were responsible for 21% of U.S. electricity generation. In order to cost-effectively achieve a Biden’s goal to create a carbon-free power sector by 2035, we must make sure our buildings are capable of cost effectively installing renewable energy now. According to a recent study entitled “A New Roadmap for the Lowest Cost Grid”, the least expensive grid involves a large amount of centralized renewables and a large amount of distributed renewables located on the building site. More renewables placed on site enables more clean utility-scale renewables to be deployed efficiently. It is therefore crucial for new residential buildings to be solar-ready so that the U.S. can reach its 100% carbon-free electricity goal by 2035 in the most cost-effective manner. Installing renewables on-site will also allow homeowners to economically benefit from the transition towards a low-carbon economy and benefit from additional resiliency during disruptions in centrally supplied power.

In addition, this solar-ready requirement would help grow good paying jobs. According to the Bureau of Labor Statistics, the two fastest growing occupations in the US are solar PV and wind turbine service technician. The Interstate Renewable Energy Council estimates that to reach Biden’s target of 100% renewable energy by 2035, the industry will need to employ three times the number of workers employed in 2020.

The proposed revisions and additions to the code have been moved from the 2021 IECC Appendix RB Solar-Ready Provisions to the most appropriate place in the base code. The amendments would require all new homes to be solar ready by requiring a designated 300 square foot minimum “solar ready zone” on the roof. Conduit and wire from this zone must be installed and space in the electrical panel must be reserved for a future solar array. Homes where solar is not feasible due to shading or not enough solar exposure due to orientation are exempt. Information on compliance with this requirement must be placed on the construction documents to improve compliance and so that future homeowners know their home is solar-ready. Revisions to Table R405.2 and R406.2 make this a mandatory requirement in the energy code. This amendment points multifamily buildings (Group R-2 and R-3 occupancies) to a similar amendment in the commercial energy code. If the residential committee chooses

to accept this amendment but the commercial solar amendment is not accepted by the commercial committee, this amendment should be revised accordingly.

References:

Renewables Became the Second-Most Prevalent U.S. Electricity Source in 2020, U.S. Energy Information Administration, <https://www.eia.gov/todayinenergy/detail.php?id=48896>.

Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies, The White House, 22 Apr. 2021, <https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/>.

Why Local Solar For All Costs Less: A New Roadmap for the Lowest Cost Grid, Vibrant Clean Energy, Dec. 2020, www.vibrantcleanenergy.com/wp-content/uploads/2020/12/WhyDERs_ES_Final.pdf.

The National Solar Job Census 2020, Interstate Renewable Energy Council, May 2021, <https://irecusa.org/wp-content/uploads/2021/07/National-Solar-Jobs-Census-2020-FINAL.pdf>.

Richardson, Jake. *Solar and Wind Tech Are the Fastest Growing Jobs in US*, Red, Green, and Blue, 28 Jan. 2019, <http://redgreenandblue.org/2019/01/27/solar-wind-tech-fastest-growing-jobs-us/>.

Resiliency Impact Statement: This proposal will increase Resiliency

Resiliency is an essential component of adapting to the effects of climate change. As we see increasing number of severe weather events, the electric grid's ability to withstand these events will become increasingly important. Community resilience will be increasingly dependent on distributed generation, and more localized production can help buildings and communities keep power when other areas of the grid may be offline. This local production of power can support critical functions and provide life supporting functions of small/at home medical devices that require on power, allowing for needed cell phone charging to stay in touch during an emergency, and literally keeping the lights on for safety and security.

Cost Impact: The code change proposal will increase the cost of construction

Recent analysis by NBI and partners using cost data from RSMMeans indicates that adding the infrastructure to make a home solar ready would cost \$216 or \$0.09 per square foot for a typical home at the time of construction. According to an NREL report, if a home is not made solar ready but chooses to add solar at a later date, the cost of the retrofit (if the retrofit is feasible) is \$4,373 or \$1.84 per square foot, assuming a 2,376 s.f. home. Therefore, adding the infrastructure to make a home solar ready now saves \$4,157 or \$1.75 per square foot for homeowners who choose to add solar at a later date.

References:

Solar Ready: An Overview of Implementation Practices, National Renewable Energy Laboratory, Jan. 2012, www.nrel.gov/docs/fy12osti/51296.pdf.

2018 VUSBC AND I-CODE PROVISIONS APPLICABLE TO CONSTRUCTION IN FLOOD HAZARD AREAS

Red underlined and ~~strikethrough~~ are proposed changes to provide resilience.

Proposal 1—Minor Edits to More Closely Conform to NFIP and Remove Contradictory Terms

USBC - Virginia Construction Code (VCC and IBC)

103.4 Use of certain provisions of referenced codes. The following provisions of the IBC and of other indicated codes or standards are to be considered valid provisions of this code. Where any such provisions have been modified by the state amendments to the IBC, then the modified provisions apply.

1. Special inspection requirements in Chapters 2 - 35.
2. Testing requirements and requirements for the submittal of *construction* documents in any of the ICC codes referenced in Chapter 35 and in the IRC.
3. Section R301.2 of the IRC authorizing localities to determine climatic and geographic design criteria.
4. Flood load or flood-resistant *construction* requirements in the IBC or the IRC, including, but not limited to, any such provisions pertaining to flood elevation certificates that are located in Chapter 1 of those codes. Any required flood elevation certificate pursuant to such provisions shall be prepared by a land surveyor or engineer licensed in Virginia ~~or a registered design professional (RDP)~~.
5. Section R101.2 of the IRC.
6. Section N1102.1 of the IRC and Sections C402.1.1 and R402.1 of the IECC.

108.2 Exemptions from application for permit.

* * *

Exceptions:

1. Application for a permit may be required by the building official for the installation of replacement siding, roofing and windows in buildings within a historic district designated by a locality pursuant to Section 15.2-2306 of the Code of Virginia.
2. Application for a permit ~~may shall~~ be required by the building official for ~~any~~ items ~~otherwise~~ exempted in this section which are located within a special flood hazard area.

Change the following definitions in Section 202 of the IBC to read:

[BS] BASE FLOOD ELEVATION. The elevation of the base flood, including wave height, relative to the National Geodetic Vertical Datum (NGVD), North American Vertical Datum (NAVD) or other datum specified on the Flood Insurance Rate Map (FIRM), and as shown in the Flood Insurance Study.

[BS] COASTAL A ZONE. Area within a special flood hazard area, landward of a V zone or landward of an open coast without mapped *Coastal High Hazard Areas*. In a *Coastal A Zone*, the principal source of flooding must be astronomical tides, storm surges, seiches or tsunamis, not riverine flooding. During the base flood conditions, the potential for breaking wave height shall be greater than or equal to 1-1/2 feet (457 mm), and not greater than three feet (90 cm). The inland limit of the *Coastal A Zone* is (a) the Limit of Moderate Wave Action if delineated on a FIRM, or (b) designated by the authority having jurisdiction.

[BS] COASTAL HIGH HAZARD AREA. Area within the special flood hazard area extending from offshore to the inland limit of a ~~primary dune~~ Coastal Primary Sand Dune, as defined by state code (Code of Virginia Title 28.2), along an open coast and any other area that is subject to high-velocity wave action from storms or seismic sources, and shown in either the Flood Insurance Study, or on the Flood Insurance Rate Map (FIRM) or other flood hazard map as velocity Zone V, VO, VE or V1-30 (areas subject to wave heights of 3 feet (90 cm) or more).

[BS] DESIGN BASE FLOOD. The flood associated with the greater of the following two areas:

1. Area with a flood plain subject to a 1-percent or greater chance of flooding in any year (also known as the 100-year floodplain).
2. Area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated, including areas shown in either the Flood Insurance Study or on the Flood Insurance Rate Map (FIRM).

[A] EXISTING BUILDING. A building erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued. For application of provisions in flood hazard areas, an existing building is any building for which a complete building permit application was submitted, diligently pursued before the effective date of the community's first flood plain management code, ordinance, or standard, and provided that all work was carried out to completion without expiration of the legally issued building permit.

[BS] EXISTING STRUCTURE. A building erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued. For application of provisions in flood hazard areas, an existing structure is any structure for which a complete building permit application was submitted, diligently pursued before the effective date of the community's first flood plain management code, ordinance, or standard, and provided that all work was carried out to completion without expiration of the legally issued building permit.

[BS] [FLOOD or FLOODING].

1. A general and temporary condition of partial or complete inundation of normally dry land from either of the following:
 - 1.1 The overflow of inland or tidal waters.

- 1.2 The unusual and rapid accumulation or runoff of surface waters from any source.
2. The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in subsection (1.1) of this definition.
 3. Mudflows which are proximately caused by flooding as defined in subsection (1.2) of this definition and are akin to a river of liquid and flowing mud on the surface of normally dry land areas, as when earth is carried by a current of water and disposed along the path of the current.

FLOOD, DESIGN BASE. See “Design Base flood”

[BS] FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of flooding in any year (also known as the 100-year floodplain).
2. The area designated as a *flood hazard area* on a community’s flood hazard map, or otherwise legally designated, including areas shown in either the *Flood Insurance Study* or on the *Flood Insurance Rate Map (FIRM).*

[BS] FLOODWAY. The channel of the river, creek or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height as designated on a community’s flood hazard map, or otherwise legally designated, including areas shown in either the *Flood Insurance Study* or on the *Flood Insurance Rate Map (FIRM).*

[IBC] SPECIAL FLOOD HAZARD AREA. The land area subject to flood hazards and shown on a Flood Insurance Rate Map or ~~other flood hazard map~~ the *Flood Insurance Study* as Zone A, AE, A1-30, A99, AR, AO, AH, V, VO, VE or V1-30.

[BS] SUBSTANTIAL IMPROVEMENT. Any repair, reconstruction, rehabilitation, alteration, addition, or other improvement of a building or structure or a portion thereof the cost of which equals or exceeds 50 percent of the market value of the building or structure before the improvement or repair is started. If the structure has sustained substantial damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The term does not, however, include ~~either~~ the following:

1. Any project for improvement of a building or a structure or portion thereof required to correct existing health, sanitary, or safety code violations identified by the building official and that is the minimum necessary to assure safe living conditions; or

2. Any alteration of a historic structure, provided that the alteration will not preclude the building or structure's continued designation as a historic building or structure; or
3. Any improvements necessary with elevating a structure above the design flood elevation; or
4. Buildings or structures located outside of the special flood hazard area but within a locally designated flood hazard area [or flood and coastal wind resilience area], if the locality's regulatory standards specifically exempt such locally designated flood hazard area from the substantial improvement provisions of the VCC, or from any other locally adopted substantial improvement requirement.

[IBC] 802.4 Applicability. For buildings in flood hazard areas as established in Section 1612.3, interior finishes, trim and decorative materials below the design flood elevation required by Section 1612 shall be flood-damage-resistant materials.

[IBC] 1603.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.4, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. Flood design class assigned according to *ASCE 24*.
2. In *flood hazard areas* other than *Coastal High Hazard Areas* or *Coastal A Zones*, the elevation of the proposed lowest floor, including the basement.
3. In *flood hazard areas* other than *Coastal High Hazard Areas* or *Coastal A Zones*, the elevation to which any nonresidential building will be dry floodproofed.
4. In *Coastal High Hazard Areas* and *Coastal A Zones*, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement, or the grade beam if not located below the depth of anticipated scour/erosion as determined by the 1% annual chance coastal flood event caused by the combined effects of wind and water loads acting simultaneously on all building components in accordance with ASCE 7-10, Minimum Design Loads for Buildings and Other Structures.

[IBC] 1612.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official on an approved National Flood Insurance Program Elevation Certificate (FEMA Form 086-0-33):

1. For construction in flood hazard areas other than *Coastal High Hazard Areas* or *Coastal A Zones*:
 - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 113.3.2 and for the final inspection in Section 113.3.
 - 1.2. For fully enclosed areas below the *design flood elevation* where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of *ASCE 24*, construction documents shall include a

statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

- 1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24.
2. For construction in *Coastal High Hazard Areas* or *Coastal A Zones*:
 - 2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.10.1.
 - 2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.
 - 2.3. ~~For breakaway walls are prohibited designed to have a resistance of more than 20 psf (0.96 kN/m²) determined using allowable stress design, construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.~~

[IBC] 1805.1.2.1 Flood hazard areas. For buildings and structures in flood hazard areas as established in Section 1612.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on at least one side.

~~Exception: Under floor spaces of Group R-3 buildings that meet the requirements of FEMA TB 11.~~

USBC - Virginia Residential Code

Modify the Definitions in Part II to read as follows:

FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a floodplain subject to a 1 percent or greater chance of flooding in any given year (also known as the 100-year floodplain).
2. This area designated as a *flood hazard area* on a community's flood hazard map, or otherwise legally designated, including areas shown in either the *Flood Insurance Study* or on the *Flood Insurance Rate Map (FIRM)* and including areas added to account for future flooding conditions based on the locally adopted sea level rise projected to occur by 2070.

R322.1.3 Flood-resistant construction. Buildings and structures erected in areas prone to flooding shall be constructed by methods and practices that minimize flood damage in accordance with FEMA TB-2 and ASCE 24.

R322.1.5 Lowest floor. The lowest floor shall be the lowest floor of the lowest enclosed area, including basement, and excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited (200 square feet or less) storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

R322.1.6 Protection of mechanical, plumbing and electrical systems. Electrical systems, *equipment* and components; heating, ventilating, air conditioning; plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall be located at or above the elevation required in Section R322.2 or R322.3. If replaced as part of a substantial improvement, electrical systems, *equipment* and components; heating, ventilating, air conditioning and plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall meet the requirements of this section. Systems, fixtures, and *equipment* and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

Exception: ~~Locating electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment is permitted below the elevation required in Section R322.2 or R322.3 provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in accordance with ASCE 24.~~ Electrical wiring systems are permitted to be located below the required elevation provided that they conform to the provisions of the electrical part of this code for wet locations in accordance with FEMA P-348.

R322.1.8 Flood-resistant materials. Building materials and installation methods used for flooring and interior and exterior walls and wall coverings below the elevation required in Section R322.2 or R322.3 shall be flood damage-resistant materials that conform to the provisions of FEMA TB-2 and ASCE 24.

R322.1.9 Manufactured homes. The bottom of the frame of new and replacement *manufactured homes* on foundations that conform to the requirements of Section R322.2 or R322.3, as applicable, shall be elevated to or above the design flood elevations specified in Section R322.2 (flood hazard areas including A Zones) or R322.3 in *Coastal High Hazard Areas* (V Zones and *Coastal A Zones*). The anchor and tie-down requirements of the applicable state or federal requirements shall apply. The foundation and anchorage of *manufactured homes* to be located in identified floodways shall be designed and constructed in accordance with ASCE 24.

R322.2 Flood hazard areas (including A Zones). Areas that have been determined to be prone to flooding and that are not subject to high-velocity wave action shall be designated as flood hazard areas. Flood hazard areas that have been delineated as subject to wave heights ~~between greater than or equal to~~ 1 1/2 feet (457 mm cm) ~~and 3 feet (914 mm)~~ or otherwise designated by the jurisdiction ~~shall be~~ are designated as either Coastal A Zones or V, VE or V1-30 Zones and are subject to the requirements of Section R322.3. Buildings and structures constructed in whole or in part in flood hazard areas shall be designed and constructed in accordance with Sections R322.2.1 through R322.2.3.

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas not designated as Coastal A Zones, shall have the lowest floors elevated to or above either the base flood elevation plus ~~1 foot~~ 3 feet (305 915 mm), or the *design flood elevation*, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated to a height above the highest adjacent grade of not less than the depth number specified in feet (mm) on the FIRM plus ~~1 foot~~ 3 feet (305 915 mm), or not less than ~~3~~ 5 feet (915 1525 mm) if a depth number is not specified.
3. Basement floors that are below grade on all sides are prohibited ~~shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.~~
4. Garage and carport floors shall comply with one of the following:
 - 4.1. They shall be elevated to or above the elevations required in Item 1 or Item 2, as applicable.
 - 4.2. They shall be at or above grade on not less than one side. Where a garage or carport is enclosed by walls, the garage or carport shall be used solely for parking, building access or storage and the walls shall be constructed of flood resistant materials.

Exception: Enclosed areas below the elevation required by this section, including basements with floors that are not below grade on all sides, shall meet the requirements of Section R322.2.2.

R322.2.2 Enclosed area below design flood elevation. Enclosed areas, including crawl spaces, that are below the *design flood elevation* shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria and are installed in accordance with Section R322.2.2.1:
 - 2.1. The total net area of nonengineered flood openings shall be not less than 1 square inch (645 mm²) for each square foot (0.093 m²) of enclosed area where the enclosed area is measured on the exterior of the enclosure walls, or the flood openings shall be designed as engineered flood openings and the *construction documents* shall include a statement by a registered *design professional* that the design of the flood openings will provide for equalization of hydrostatic flood forces on *exterior walls*

by allowing for the automatic entry and exit of floodwaters as specified in Section 2.6.2.2 of ASCE 24 and in FEMA TB-1.

- 2.2. Flood Openings shall be not less than 3 inches (~~76 mm~~ 8 cm) in any direction in the plane of the wall.
- 2.3. The presence of louvers, blades, screens and faceplates or other covers and devices shall allow the automatic flow of floodwater into and out of the enclosed areas and shall be accounted for in the determination of the net open area.

R322.2.2.1 Installation of openings. The walls of enclosed areas shall have flood openings installed such that:

1. There shall be not less than two openings on different sides of each enclosed area; if a building has more than one enclosed area below the *design flood elevation*, each area shall have flood openings.
2. The bottom of each flood openings shall be not more than 1 foot (305 ~~mm~~ cm) above the higher of the final interior grade or floor ~~and or~~ the finished exterior grade immediately under each flood openings.
3. Flood Openings shall be permitted to be installed in doors and windows; doors and windows without installed flood openings do not meet the requirements of this section.

R322.3.1 Location and site preparation.

1. New buildings and buildings that are determined to be substantially improved pursuant to Section R105.3.1.1 shall be located landward of the reach of mean high tide.
2. For any alteration of sand dunes and mangrove stands, the building official shall require submission of an engineering analysis and a satisfactory Comment Document from FEMA for a Conditional Letter of Map Revision (CLOMR) that demonstrates that the proposed alteration will not increase the potential for flood damage.

R322.3.3 Foundations. Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns.

1. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.5.
2. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling.
3. Columns and their supporting foundations shall be designed to resist combined wave and wind loads, lateral and uplift, and shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the columns. Spread footing, mat, raft or

other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24. Grade beams shall be located below the lowest expected eroded surface.

4. Flood and wave loads shall be associated with the design flood. Wind loads shall be those required by this code.

5. Foundation designs and construction documents shall be prepared and sealed in accordance with Section R322.3.9.

~~**Exception:** In Coastal A Zones, stem wall foundations supporting a floor system above and backfilled with soil or gravel to the underside of the floor system shall be permitted provided the foundations are designed to account for wave action, debris impact, erosion and local scour. Where soils are susceptible to erosion and local scour, stem wall foundations shall have deep footings to account for the loss of soil.~~

R322.3.5 Walls below *design flood elevation*. Walls and partitions ~~are permitted~~ below the elevated floor are prohibited in Coastal A Zones or Coastal High Hazard Areas. ~~provided that such walls and partitions are not part of the structural support of the building or structure and:~~

- ~~1. Electrical, mechanical and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and~~
- ~~2. Are constructed with insect screening or open lattice; or~~
- ~~3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a resistance of not less than 10 (479 Pa) and not more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or~~
- ~~4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), as determined using allowable stress design, the *construction documents* shall include documentation prepared and sealed by a registered *design professional* that: 4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the base flood. 4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on structural and nonstructural building components. Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code.~~
- ~~5. Walls intended to break away under flood loads as specified in Item 3 or 4 have flood openings that meet the criteria in Section R322.2.2, Item 2.~~

R322.3.6 Enclosed areas below *design flood elevation*. Enclosed areas below the *design flood elevation* in Coastal A Zones or Coastal High Hazard Areas are prohibited shall be used solely for parking of vehicles, building access or storage.

R322.3.6.1 Protection of building envelope. An exterior door that meets the requirements of Section R609 shall be installed at the top of stairs that provide access to the building ~~and that are enclosed with walls designed to break away in accordance with Section R322.3.4.~~

R322.3.10 Tanks. Underground tanks are prohibited in Coastal A Zones or Coastal High Hazard Areas shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the *design flood elevation* required in Section R322.3.2. Where elevated on platforms, the platforms shall be cantilevered from or knee braced to the building or shall be supported on foundations that conform to the requirements of Section R322.3.

USBC - Virginia Existing Building Code

103.9 Construction documents. Construction documents shall be submitted with the application for a permit. The work proposed to be performed on an existing building or structure shall be classified on the construction documents as repairs, alterations, change of occupancy, addition, historic building, or moved building. Alterations shall further be classified as Level 1 or Level 2. Any required flood elevation certificate shall be prepared by a certified land surveyor or registered professional engineer licensed in Virginia.

Exception: Construction documents or classification of the work does not need to be submitted when the building official determines the proposed work does not require such documents, classification, or identification.

Proposal 2—Establish Minimum Freeboard in Floodplains at 3 Feet

USBC - Virginia Construction Code (VCC and IBC)

Change the following definitions in Section 202 of the IBC to read:

[BS] DESIGN FLOOD ELEVATION. The *base flood elevation* of the “~~design base~~ flood,” including wave height, plus three feet of freeboard, relative to the datum specified on the community’s legally designated flood hazard map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the building’s perimeter plus the depth number (in feet) specified on the flood hazard map, plus 3 feet (90 cm) of freeboard. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (~~610 mm~~ 60 cm).

USBC - Virginia Residential Code

Modify the Definitions in Part II to read as follows:

DESIGN FLOOD ELEVATION. The elevation of the “design flood,” including wave height, relative to the datum specified on the community’s legally designated flood hazard map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the *building’s* perimeter plus the depth number, in feet, plus 3 feet (915 mm) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2.5 feet (1525 mm) (610 mm).

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas not designated as Coastal A Zones, shall have the lowest floors elevated to or above either the base flood elevation plus ~~1 foot~~ 3 feet (915 mm), or the *design flood elevation*, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated to a height above the highest adjacent grade of not less than the depth number specified in feet (mm) on the FIRM plus ~~1 foot~~ 3 feet (915 mm), or not less than ~~3~~ 5 feet (~~915~~ 1525 mm) if a depth number is not specified.
3. Basement floors that are below grade on all sides are prohibited ~~shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.~~

Proposal 3—Add Qualification Requirements for Building Officials in Coastal Localities

USBC - Virginia Construction Code (VCC and IBC)

105.1.1 Qualifications of building official. The building official shall have at least five years of building experience as a licensed professional engineer or architect, building, fire or trade inspector, contractor, housing inspector or superintendent of building, fire or trade *construction* or at least five years of building experience after obtaining a degree in architecture or engineering, with at least three years in responsible charge of work. Any combination of education and experience that would confer equivalent knowledge and ability shall be deemed to satisfy this requirement. The building official shall have general knowledge of sound engineering practice in respect to the design and *construction* of structures, the basic principles of fire prevention, the accepted requirements for means of egress and the installation of elevators and other service *equipment* necessary for the health, safety and general welfare of the occupants and the public. In localities in Coastal Virginia, the building official shall have

general knowledge of the principles and requirements of floodplain and high-velocity wind construction. The *local governing body* may establish additional qualification requirements.

105.2.1 Qualifications of technical assistants. A technical assistant shall have at least three years of experience and general knowledge in at least one of the following areas: building construction; building construction conceptual and administrative processes; building, fire or housing inspections; plumbing, electrical or mechanical trades; or fire protection, elevator or property maintenance work. In localities in Coastal Virginia, technical assistants shall have general knowledge of the principles and requirements of floodplain and high-velocity wind construction. Any combination of education and experience that would confer equivalent knowledge and ability, including high school technical training programs or college engineering, architecture, or construction degree programs, shall be deemed to satisfy this requirement. The *locality* may establish additional qualification requirements.

105.2.2 Certification of technical assistants. A technical assistant shall be certified in the appropriate subject area within 18 months after becoming a technical assistant. When required by local policy to have two or more certifications, a technical assistant shall obtain the additional certifications within three years from the date of such requirement. In localities in Coastal Virginia, at least one technical assistant shall be a Certified Floodplain Manager (CFM) or hold an equivalent certification in floodplain construction requirements.

Proposal 4—Add Inspections in Floodplains

USBC - Virginia Construction Code (VCC and IBC)

113.3 Minimum inspections. The following minimum inspections shall be conducted by the building official when applicable to the construction or permit:

1. Inspection of footing excavations and reinforcement material for concrete footings prior to the placement of concrete.
2. Inspection of foundation systems during phases of construction necessary to assure compliance with this code.
3. Inspection of preparatory work prior to the placement of concrete.
4. Inspection of the elevation of the lowest floor in accordance with Section 110.3.3 prior to further vertical construction located in any flood hazard area or special flood hazard area.
5. Inspection of structural members and fasteners prior to concealment.
6. Inspection of electrical, mechanical and plumbing materials, equipment and systems prior to concealment.
7. Inspection of energy conservation material prior to concealment.
8. Inspection of the elevation of the lowest floor in accordance with Section 110.3.10.1 prior to final inspection located in any flood hazard area or special flood hazard area.
9. Final inspection.

113.3.2 Lowest floor elevation. In flood hazard areas, upon placement of the lowest floor, including the basement, and prior to further vertical construction, the elevation certification required in Section 1612.5 shall be submitted to the building official.

113.3.3 Flood hazard documentation. If located in a flood hazard area, documentation of the elevation of the lowest floor as required in Section 1612.5 shall be submitted to the building official prior to the final inspection.

Proposal 5—Establish Resilience Areas

USBC - Virginia Construction Code (VCC and IBC)

[Note: This can be set up as either a mandatory provision or by locality adoption—as drafted here, the local adoption approach is used, but can be changed to mandatory if the subworkgroup determines that a mandatory approach is more appropriate]

102.2.2 Flood and coastal wind hazard resilience areas. Notwithstanding the foregoing restrictions on scope, localities within Coastal Virginia may, but are not required to, establish flood and coastal wind hazard resilience areas. Within flood and coastal wind hazard resilience areas, all development in these coastal areas of the Commonwealth shall be designed and constructed to resist all forces placed on buildings related to tropical cyclones, Nor'easters, high-tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea-level rise. This shall require that for any new construction within Resilience Areas, the resulting structure shall be stronger, more resilient and less subject to risks from flooding and high winds than may otherwise be provided in this Code. The following shall be included in flood and coastal wind resilience areas:

1. A sea-level rise factor shall be incorporated into plans for all new construction subject to this Code. At a minimum, the factor shall consider 50 years of projected sea-level rise using a locally adopted method and projection. In the absence of a locally adopted method, the design of permanent structures shall include three feet (90cm) of sea level rise plus three feet (90cm) of freeboard to the lowest habitable floor elevation.
2. The mandated use of FEMA Technical Bulletin best practices for coastal construction shall be required within resilience areas. Specifically included are FEMA TB-5, Free-of-Obstruction Requirements, FEMA TB-8, Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas and FEMA P-550, Recommended Residential Construction for Coastal Areas.
3. Both a primary and an alternate continuous load path from roof to foundation shall be provided in each new building subject to this Code and shall be certified by an RDP as sufficient to manage the lateral, twisting or racking, uplift and compression forces expected to act on the structure over the expected lifespan of the structure or 50 years, whichever is the greater timeframe.

4. The mandated use of recognized performance- and resilience-based codes shall be permitted by local adoption within resilience areas, provided that the relevant portions of such codes are used in their entirety.
5. Restrictions on the construction and use of basements shall be a permissible local adoption.

Add the following definitions to Section 202 of the IBC to read:

FLOOD AND COASTAL WIND HAZARD RESILIENCE AREAS. A designation in the local government comprehensive plan of coastal communities in the Commonwealth which identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, tropical cyclones, Nor'easters, flash floods, stormwater runoff and that are vulnerable to the related impacts of rising sea level for the purpose of prioritizing funding for infrastructure needs and adaptation planning, including establishment of higher standards for building construction, reconstruction, alteration and repair within the Resilience Area. Examples of Flood and Coastal Wind Resilience Areas may include, but are not limited to designated floodplains and special flood hazard areas, Chesapeake Bay Preservation Areas, designated evacuation zones and routes, areas determined by modelling to be at risk from recurrent flooding resulting from sea level rise within fifty years, areas within 1000 feet of the coastline of the ocean, bay or estuarian reach of a tidal river and other similar areas designated within the local comprehensive plan. Any locality in Coastal Virginia may adopt *Flood and Coastal Wind Resilience Areas* but shall not be obligated to do so.

USBC - Virginia Existing Building Code

102.2 Scope. The provisions of this code shall govern construction and rehabilitation activities in existing buildings and structures except in locally designated *flood and coastal wind hazard resilience areas* (see section 102.2.4 below).

102.2.4 Reconstruction, alteration or repair in locally-designated flood and coastal wind hazard resilience areas. Within *flood and coastal wind hazard resilience areas*, existing development in coastal areas of the Commonwealth related to tropical cyclones, Nor'easters, high-tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea-level rise shall be discouraged whenever opportunities arise. This shall require that for any reconstruction, alteration or repair of an existing building within Resilience Areas, the resulting structure shall be stronger, more resilient and less subject to risks from flooding and high winds than was the case prior to work commencing. The following shall be included in *flood and coastal wind resilience areas*:

1. A sea level rise factor shall be incorporated into plans for all existing structures that are proposed to be reconstructed, altered or repaired subject to the Code. At a minimum, the factor shall consider 30 years of projected sea level rise using a locally adopted method. In the absence of a locally adopted method, the design of such structures shall

- include two feet (60 cm) of sea level rise plus three feet (90 cm) of freeboard to the lowest habitable floor elevation.
2. The mandated use of FEMA Technical Bulletin Best Practices for coastal construction shall be permitted within resilience areas.
 3. The mandated use of recognized performance- and resilience-based codes shall be permitted within resilience areas, provided that the relevant portions of such codes are used in their entirety.

VEBC Chapter 2 Definitions:

Add the following definition to read and provide as follows:

FLOOD AND COASTAL WIND HAZARD RESILIENCE AREAS. A designation in the local government comprehensive plan of coastal communities in the Commonwealth which identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, tropical cyclones, Nor'easters, flash floods, stormwater runoff and that are vulnerable to the related impacts of rising sea level for the purpose of prioritizing funding for infrastructure needs and adaptation planning, including establishment of higher standards for building construction, reconstruction, alteration and repair within the Resilience Area. Examples of Flood and Coastal Wind Resilience Areas may include, but are not limited to designated floodplains and special flood hazard areas, Chesapeake Bay Preservation Areas, designated evacuation zones and routes, areas determined by modelling to be at risk from recurrent flooding resulting from sea level rise within fifty years, areas within 1000 feet of the coastline of the ocean, bay or estuarian reach of a tidal river and other similar areas designated within the local comprehensive plan. Any locality in Coastal Virginia may adopt *Flood and Coastal Wind Hazard Resilience Areas* but shall not be obligated to do so.

Modify the following definition to read and provide as follows:

SUBSTANTIAL IMPROVEMENT. For the purpose of determining compliance with the flood provisions of this code, any improvement, including repair, reconstruction, rehabilitation, alteration, or addition, or other improvement of a building or structure or a portion thereof, located within a flood hazard area or special flood hazard area or flood and coastal wind resilience area, the cost of which equals or exceeds 50% of the market value of the building or structure before the improvement or repair is started. If the building or structure or portion thereof has sustained substantial damage, any improvements are considered substantial improvements regardless of the actual improvement performed. The term does not, however, include either:

1. Any project for improvement of a building or a structure or portion thereof required to correct existing health, sanitary, or safety code violations identified by the building official and that is the minimum necessary to assure safe living conditions; or
2. Any alteration of a historic structure, provided that the alteration will not preclude the building or structure's continued designation as a historic building or structure.

3. Buildings or structures located outside of the *special flood hazard* area but within a *flood hazard area* or *flood and coastal wind resilience area* designated by the locality, if the locality's regulatory standards specifically exempt such flood hazard area from the substantial improvement provisions of the VEBC, or from any other locally adopted substantial improvement requirement.
4. Any improvements necessary with elevating a structure above the *design flood elevation*.